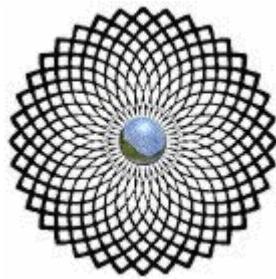


**3<sup>RD</sup> ANNUAL MEETING  
ASSOCIATION FOR THE SCIENTIFIC STUDY OF  
CONSCIOUSNESS**

**THE UNIVERSITY OF WESTERN ONTARIO  
LONDON ONTARIO CANADA  
JUNE 4-7 1999**

***CONSCIOUSNESS AND SELF:  
NEURAL, COGNITIVE, AND  
PHILOSOPHICAL ISSUES***



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**CONSCIOUSNESS AND SELF:  
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AND PHILOSOPHICAL ISSUES**

**LONDON ONTARIO JUNE 4-7 1999**

**PROGRAM**

All meetings and workshops will be held in the Social Science Centre (SSC) of the University of Western Ontario

**Friday June 4**

**Workshops**

**9:00 Pre-conference workshops I**

Chris Frith	(Room 3116)
Vittorio Gallese	(Room 3103)
Eduard Marbach	(Room 3107)
Ravi Menon	(Room 3207)
Howard Shevrin	(Room 3108)
Douglas Watt	(Room 3102)

**12:00 Lunch**

**2:00 Pre-conference workshops II**

Ralph Ellis & Natika Newton	(Room 3108)
James Newman & Antti Revonsuo	(Room 3207)
Nicholas Schiff	(Room 3103)
Don Simons & Ron Rensink	(Room 3102)
John Smythies	(Room 3107)

**5:00 End**

**6:30 Informal reception at Graduate Student Pub  
(Middlesex College)**

**Saturday June 5**

All Plenary Sessions will be in Room 2050 SSC

**8:15 Welcome:**

Mel Goodale, President of ASSC  
Greg Moran, Provost and Vice-President Academic, University of Western Ontario

- 8:30 Plenary Talk: *What is Autonoetic Consciousness Good For?*** Endel Tulving, University of Toronto, Canada. (Chair: Mel Goodale)
- 9:30 Plenary Talk: *The Role of the Frontal Cortex in the Monitoring of Mnemonic Processes.*** Michael Petrides, McGill University, Canada. (Chair: Mel Goodale)
- 10:30 Coffee**
- 11:00 Plenary Forum : *Consciousness and Metacognition.*** Tom Nelson, University of Maryland, USA and David Rosenthal, City University of New York, USA. (Chair: David Chalmers)
- 12:30 Lunch**
- 1:45 Concurrent Sessions 1**
- I.1 Self-awareness and higher-order thought**  
E. Marbach, R. Van Gulick, T. Bayne , E. Myin (Chair: Jillian McIntosh: Room 3014)
- I.2 Attention and Imagery**  
S. Grossberg, P. Wilken, L. Lou, J. Andrade (Chair: Keith Humphrey: Room 2036)
- I.3 Brain Imaging and Neurochemistry**  
A. Revonsuo, N. Sriram, J. Keenan, J. Smythies (Chair: Antti Revonsuo: Room 2110)
- I.4 Varieties of Memory**  
R. Hampton, W. Banks, B. Levine, S.Sikström (Chair: William Banks : Room 2032)
- 3:45 Tea**
- 4:00 Plenary Symposium: *Consciousness, Self, and Other Minds*** (Chair: William Banks)
- Attending to other people's mental states.** Alan Leslie, Rutgers University, USA.
- The Mirror Test.** Gordon Gallup, Jr., State University of New York at Albany, USA.
- 5:30 Poster Session 1 (see below) and Cash Bar**
- 7:30 Reception and Banquet, Great Hall, Somerville House**

**Sunday June 6**

All Plenary Sessions will be in Room 2050 SSC

- 8:30 Plenary talk: *Neurones that perceive faces: Face Perception and responses of brain cells.*** David Perrett (and C. Keysers), University of St. Andrews, Scotland, UK (Chair: Keith Humphrey)

<b>9:30</b>	<b>Plenary talk: <i>The knowledge of the internal activities of conscious minds: a neurophysiological perspective.</i></b> Giacomo Rizzolatti, University of Parma, Italy. (Chair: Keith Humphrey)
<b>10:30</b>	<b>Coffee</b>
<b>11:00</b>	<b>Plenary Symposium: <i>The Nature of the Will</i></b> (Chair: William Demopoulos)  <i>Apparent Mental Causation: Sources of the Illusion of Conscious Will.</i> Dan Wegner (and Thalia Wheatley), University of Virginia, USA.  <i>Phenomenal Volition and Agenthood: An Application for the Self-Model Theory of Subjectivity.</i> Thomas Metzinger, Germany
<b>12:30</b>	<b>Lunch</b>
<b>1:45</b>	<b>Concurrent Sessions 2</b> <b>2.1 Explanatory Gap</b> T. Polger, F. Radovic, N. Newton, L. Dempsey (Chair: Jillian McIntosh: Room 3014 ) <b>2.2 Conscious and Unconscious Perceptual Processes</b> M. Price, M. Herzog, E. Strahan, S. Vaishnavi (Chair: Patrick Wilken: Room 2036) <b>2.3 Self and Action</b> S. Blakemore, G. Knoblich, A. Slachevsky, I.Whishaw (Chair: Ian Whishaw: Room 2032) <b>2.4 Cognitive Models of Consciousness</b> J. May, G. O'Brien, K. McGovern, D. Watt (Chair: Douglas Watt: Room 2110)
<b>3:45</b>	<b>Tea</b>
<b>4:00</b>	<b>Plenary Symposium: <i>Faces, Self, and Consciousness</i></b> (Chair: Mel Goodale)  <i>Interactions between face and self revealed by personal accounts of facial difference.</i> Jonathan Cole, University of Southampton, UK.  <i>Neural correlates of changes in perceptual awareness in the absence of changes in the stimulus</i> Nancy Kanwisher, MIT, USA.  <i>Face and object recognition: Competition for conscious awareness in agnosia and normal perception.</i> Morris Moscovitch, University of Toronto, Canada.
<b>6:15</b>	<b>Poster Session 2 (see below) and Cash Bar</b>

## Monday June 7

All Plenary Sessions will be in Room 2050 SSC

<b>8:30</b>	<b>Plenary Talk: <i>Understanding disorders of the awareness of control.</i></b> Chris Frith, University College, London. (Chair: Peter Williamson)
<b>9:30</b>	<b>Plenary Talk: <i>Consciousness of Action and Self-Consciousness.</i></b> Marc Jeannerod, Institut des Sciences Cognitives, Lyon, France (Chair : Mel Goodale)
<b>10:30</b>	<b>Coffee</b>
<b>11:00</b>	<b>Concurrent Sessions 3</b> <b>3.1 Meaning, Language, and Consciousness</b> G. Lyon, D. Perlis, M. Stamenov (Chair: Jillian McIntosh: Room 3014) <b>3.2 Visual Consciousness</b> C. Keysers, K. Mogi, B. Bridgeman (Chair: Jody Culham: Room 2036) <b>3.3 Schizophrenia</b> S. Gallagher, H. Walter, G. Northoff (Chair: Peter Williamson: Room 2032) <b>3.4 Pain and Consciousness</b> P. McGrath, H. Merskey, R. Chapman (Chair: C. Richard Chapman: Room 2110)
<b>12:30</b>	<b>Lunch</b>
<b>1:45</b>	<b>Concurrent Sessions 4</b> <b>4.1 Evolution and Epistemology of Consciousness</b> A. Goldman, A. Bailey, S. Miller, J. Fernandez (Chair: Jillian McIntosh: Room 2110) <b>4.2 Contents of Visual Consciousness</b> J. Danckert D. Smilek, J. Beeckmans, D. Rose (Chair: Jody Culham: Room 2036) <b>4.3 Self and Agency</b> J. Barresi, R. Carlson, N. Breen, D. Galin (Chair: David Galin: Room 3014) <b>4.4 Unconscious Processes</b> E. Bernat, A. Cleeremans, K. Kotovsky, M. Snodgrass (Chair: Axel Cleeremans: Room 2032)
<b>3:45</b>	<b>Tea</b>
<b>4:00</b>	<b>Final Panel Discussion and Close</b>
<b>6:00</b>	<b>Farewell Party, Grad Pub, Middlesex College</b>

## **Poster Sessions (Lower Floor SSC)**

### **Poster Session 1**

Although posters will be put up on the morning of June 5, presenters should be at their posters at 5:30pm for the combined cash bar and poster session.

1	Sarah Creem
2	Maryjane Wraga
3	Fred Mast
4	John Eastwood,
5	Angela Haffenden
6	Yaoping Hu
7	Karin Harman
8	Linda Brakel
9	Tilo T. J. Kircher
10	Frank Szeligo
11	Mark Fenske
12	Timothy Rogier
13	Karen Nicholson
14	David Eichhorn
15	Jennifer De Osuna
16	Jean-Yves Badouin
17	Patricia Christidis
18	Diane Humphrey
19	Lis Nielsen
20	Leonard George
21	Ward O'Neil
22	John Case
23	Rimas Cuplinskas
24	Donald Borrett
25	Dennis Lomas
26	Mark Bishop
27	Alexei Samsonovich
28	Helge Malmgren
29	Volker Voelzke
30	G. Bryan Young
31	Jason Ramsay

### **Poster Session 2**

Although posters will be put up on the morning of June 6, presenters should be at their posters at 6:15 pm for the combined cash bar and poster session.

1	Maria Wilenius-Emet
2	David M. Schnyer
3	Troels W. Kjaer
4	Katja Valli
5	Krista Tarkko
6	Ian R. Newby-Clark
7	Steve Rueffer
8	Susanna Radovic
9	Sakari Kallio
10	Raffaella Ricci
11	Steve Smith
12	Paloma Enriquez
13	Laila Thaiss
14	Bill Faw
15	Karen M. L. Skene
16	Sean P. Dukelow
17	Tom James
18	Jason Connolly
19	Motoaki Sugiura
20	Jonathan Downar
21	Fumihiko Taya
22	Yoshi Tamori
23	Erik Olsson
24	Fredrik Sundqvist
25	Alexander V. Lamey
26	Slawomir Nasuto
27	Peter March
28	Thomas C. Dalton
29	Jeremy R. Gray
30	Paul Laurey
31	Norman Steinhart
32	Chlöé Farrer

## WORKSHOPS

### Schizophrenia and Consciousness

Chris Frith

Wellcome Department of Cognitive Neurology,  
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This workshop will explore three themes.

#### A) *The Neuropsychology of schizophrenia.*

It has proved difficult to identify a characteristic profile of cognitive deficits associated with a diagnosis of schizophrenia. This may be due to the considerable variability of signs and symptoms both within and between patients. An alternative approach is to identify cognitive deficits associated with particular syndromes or even specific symptoms.

#### B) *Symptoms reflecting impaired awareness of self (own mental states).*

We shall consider delusions of control and other passivity experiences and show how these might arise from an abnormality in the awareness of the control of action. A framework for understanding disorders of awareness in the motor system will be explored. Experimental evidence about the basis of delusions of control will be presented from behavioural and imaging studies.

#### C) *Symptoms reflect impaired awareness of others (mental states of others).*

We shall explore the idea that symptoms such as delusions of persecution and delusions of reference reflect a defect in the ability to make inferences about the mental states of others (mentalising). We will make comparisons between autism and schizophrenia. We will discuss experiments demonstrating impairments of mentalising in patients with schizophrenia and consider whether recent brain imaging experiments can throw any light on the cognitive and physiological basis of the ability to mentalise.

#### Readings

1. Frith, C.D. (1992) The Cognitive Neuropsychology of Schizophrenia. Lawrence Erlbaum Associates, Hove.
2. Frith, C.D. (1996) Neuropsychology of schizophrenia. British Medical Bulletin, 52, 618-626.
3. Frith, C.D. (1996) The role of the prefrontal cortex in self consciousness: the case of auditory hallucinations. Philosophical Transactions of the Royal Society of London B, 351, 1505-1512.
5. Corcoran, R., Mercer, G. & Frith, C.D. (1995) Schizophrenia, symptomatology and social inference: Investigating 'theory of mind' in people with schizophrenia. Schizophrenia Research, 17, 5-13.

### Actions, Faces, Objects and Space: How to Build a Neurobiological Account of the Self.

Vittorio Gallese

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There are many different approaches to the study of the self, perhaps as many as there are definitions. Each of these different perspectives presupposes a theoretical background

that is crucial in establishing the founding principles inspiring the choice of a given level of description.

The neurophysiological study of the functions of the primate brain, particularly research at the neuronal level of description, has for decades concentrated all its efforts trying to elucidate the functional mechanisms underlying sensation and the control of action. Neuroscientists have traditionally been extremely reluctant to address issues such as semantics and inter-subjectivity, not to mention consciousness and the self. All these issues were considered as something to be safely left in the philosophers' hands. During last part of this century we are experiencing a radical shift. The increasing attention paid to the ethological plausibility of the paradigms used to study the brain has led to a series of discoveries that have opened up the possibility of expanding the boundaries of the neurobiological enterprise. It is now possible to regard neuroscience as a good candidate for providing a biologically-relevant explanatory framework that can be successfully applied to problems central to Consciousness and Self.

This workshop will attempt to provide non-specialists with a survey of some of the most prominent findings over the last thirty years in the study of the neurophysiology of visuo-motor integration, object coding, face coding, and action representation. These results will provide a starting point for discussing possible neurobiological models of the self.

#### Readings

- 1) Carey, D.P., Perrett, D.I., Oram, M.W. Recognizing, understanding and reproducing action. In: F. Boller, J. Grafman (eds.) Handbook of Neuropsychology, vol.11, pp.111-129, Elsevier Science B.V., 1997.
- 2) Colby, C.L., Duhamel, J-R. Spatial representations for action in the parietal cortex. Cog. Brain Res. 5: 105-115, 1996.
- 3) Gallese, V., Fadiga, L., Fogassi, L., Rizzolatti, G. Action recognition in the premotor cortex. Brain 119: 593-609, 1996.
- 4) Gallese, V., Goldman, A. Mirror neurons and the simulation theory of mind-reading. TICS 2: 493-501, 1998.
- 5) Goodale, M.A., Milner, D. Separate visual pathways for perception and action. TINS 15: 20-25, 1992.
- 6) Graziano, M.S.A., Gross, C.G. Multiple pathways for processing visual space. In: C. Umiltà, M. Moscovitch (eds.) Attention and Performance, vol. XV, pp.181-207, MIT Press, 1994.
- 7) Jeannerod, M. The representing brain: neural correlates of motor intention and imagery. Behav. Brain Sci. 17: 187-245, 1994.
- 8) Jeannerod, M., Arbib, M.A., Rizzolatti G., Sakata, H. Grasping objects: the cortical mechanisms of visuomotor transformation. TINS 18: 314-320, 1995.
- 9) Rizzolatti, G., Fogassi, L., Gallese, V. Parietal cortex: from sight to action. Curr. Op. Neurobiol. 7: 562-567, 1997.
- 10) Rizzolatti, G., Arbib, M.A. Language within our grasp. TINS 21: 188-194, 1998.

- 11) Rizzolatti, G., Luppino, G., Matelli, M. The organization of the motor system: new concepts. *Electroencephal. and Cl. Neurophysiol.* 106: 283-296, 1998.
- 12) Sakata, H., Taira, M. Parietal control of hand action. *Curr. Op. Neurobiol.* 4: 847-856, 1994.

**The Phenomenological Study of Consciousness: A Survey with Special Emphasis on the Work of Edmund Husserl**

Eduard Marbach

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This workshop will introduce to the phenomenological study of conscious experiences as originally developed by the philosopher Edmund Husserl (1859-1938) who considered his phenomenology to be a "science of consciousness". The main emphasis will be on examining his methods for studying consciousness phenomenologically; for Husserl was particularly careful in elaborating methodical tools for the study of consciousness. Key concepts of the methodology to be explained are:

- Phenomenological reflection (as distinct from psychological introspection) and the question of control
- Phenomenological reduction (as distinct from 'theoretical reduction')
- Descriptive eidetic analysis of structures of conscious experiences (as a mathematically inspired analysis, proceeding by way of contrasting various experiences in order to establish invariant components of conscious experiences of one kind or another)
- Application of pure phenomenology to empirical sciences, psychology in particular (in analogy to the application of pure mathematics to science, physics in particular, in order to make it an exact science).

An important aspect will also be to explain in what sense one can speak of "laws of conscious experiences" and of "phenomenological dependencies" (or relations of foundation of one form of conscious experience upon another form).

Other important topics of phenomenology that will be covered turn upon the relationship between consciousness and intentionality (cf. "Brentano's Problem"), and upon the question of the "inner consciousness" and, especially, of the inner time consciousness as the most basic form of consciousness. Also, since the overall topic of ASSC3 is "Consciousness and Self", special attention will be given to the Husserlian approach to the question of the Self, leading him from a Humean position in his early work to a more Kantian one later on.

One of the aims of the workshop will be to show that studying consciousness with phenomenological methods is also useful to people in the sciences. More broadly, the workshop aims at conveying a more precise sense of the Husserlian enterprise that is sometimes alluded to in the circles of cognitive science and contemporary philosophy of mind, but often in a rather superficial manner.

Pertinent readings will be handed out at the workshop.

**Functional Magnetic Imaging of Perceptual Processes and Higher Cognitive Function**

Ravi S. Menon

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A large body of research in human perception/cognition has been concerned with the analysis of mental events into their presumed hierarchical processing stages, the temporal aspect of such processing being termed 'mental chronometry'. Advances in single-event functional magnetic resonance imaging (fMRI) have allowed the extraction of relative timing information between the onset of activity in different neural substrates as well as the duration of cognitive processing during a task, offering new opportunities in the study of human perception/cognition. Single-event fMRI studies have also facilitated increased spatial resolution in fMRI, allowing studies of columnar organization in humans. Since important processes such as object recognition, binocular vision and other fundamental functions are thought to be organized at the columnar level, these advances in the spatial and temporal capabilities of fMRI allow a new generation of cognitive and basic neuroscience studies to be performed, investigating the temporal and spatial relationships between these cortical sub-units. Such experiments bear a closer resemblance to single-unit or evoked-potential studies than to classical static brain activation maps and might serve as a bridge between primate electrophysiology and human subjects.

This workshop will review the basis of fMRI and demonstrate the state of the art with a number of concrete examples of fMRI in cognitive neuroscience, including mental rotations, visuo-motor tasks and imaging ocular dominance columns and contrast sensitivity functions in humans. Limitations of the technique will also be discussed.

**Readings**

- (1) Kim, S.-G., Richter, W. and Ugurbil, K. (1997) Limitations of temporal resolution in functional MRI *Magn. Reson. Med.*, 37, 631-636.
- (2) Richter, W. et al. (1997) Time-Resolved fMRI of mental rotation *Neuroreport*, 8, 3697-3702.
- (3) Menon, R. S., Luknowsky, D. L. and Gati, J. S. (1998) Mental chronometry using latency-resolved functional magnetic resonance imaging *Proc. Natl. Acad. Sci. U.S.A.* 95, 10902-10907.
- (4) Rosen, B.R., Buckner, R.L. and Dale, A.M. (1998) Event-related functional MRI: Past, present and future *Proc. Natl. Acad. Sci. U.S.A.* 95, 773-780.
- (5) Menon, R.S. and Kim, S.-G. Spatial and temporal limits in cognitive neuroimaging with fMRI. *Trends in Cognitive Science* (in press).

**Relationships between Conscious and Unconscious Processes: Different Theories and Relevant Evidence**

Howard Shevrin

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In this workshop three different theories explaining

relationships between conscious and unconscious processes will be examined in the light of recent evidence. The three theories are: 1) the controlled/automatic distinction identified with Shiffrin and Schneider, 2) a hierarchical model of attentional-motivational priorities proposed by Allport, 3) unconscious processes as providing the disposition or context for conscious processes as proposed by Baars, Searle, and others. Recent research in the areas of perception, memory, and development seen from both a cognitive and neuroscience perspective will be brought to bear on these different theories in order to evaluate their explanatory and predictive power. Problems with each of these theories will be explored in the light of the research evidence. For example, research has called into question the hard and fast distinction between conscious processes as controlled and conscious processes as automatic. Other research has challenged the close link posited between episodic memory and consciousness and procedural memory and unconscious priming. Other issues addressed in the context of recent research: the relationship of emotion and consciousness and the controversial role of unconscious motivation. The aim will be to encourage an atmosphere of free discussion of these issues and the sharing by participants of their own theories and research.

#### *Readings*

- 1). Shevrin,Bond,Brakel,Hertel & Williams (1996). Conscious and Unconscious Processes: Psychodynamic, Cognitive, and Neurophysiological Convergences, New York: Guilford Press, Chapter 3, pp.38-58; Chapter12, pp.271-275.
- 2). Allport,A (1989). Visual Attention. In M.I.Posner (ed.) Foundations of Cognitive Science (pp.631-682). Cambridge, MA: MIT Press.
- 3). Bargh, J.A. (1989). Conditional Automaticity: Varieties of autonomic influence on social perception and cognition. In J.S. Uleman & J.A.Bargh (eds.) Unintended Thought (pp.3-51). New York: Guilford Press
- 4). Baars, B.J. (1997) In the theatre of consciousness: Global Workspace theory, a rigorous scientific theory of consciousness. *J. Of Consciousness Studies*, v4(4), pp. 292-309.

#### **Emotion and Consciousness: Affective Neuroscience, Global Workspace, and the Self**

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Many believe that any meaningful theory of self and consciousness would be incomplete without a comprehensive integration of the complex phenomena of emotion. This workshop will address several topics that argue for a closer and evolutionary integration of emotion with cognition than has been generally considered in most theories of consciousness, which tend to be sensory- and/or cogno-centric. Major topic areas will include:

- 1) Review of work of leading theorists and neuroscientists in the field of "affective neuroscience" (LeDoux, Panksepp, and Damasio) examining areas of

agreement and conflict between these leading figures, particularly differing conceptions about the putative role of emotion in the neural substrates for consciousness. We will look closely at the bridging concept of global state functions (attention, pain/pleasure, volition, emotion, and self-representation) as outlining different pieces of the puzzle of a complex integrative neural envelope for consciousness.

2) Current leading "cognitive architecture" theories of consciousness that emphasize "global workspace," and its substrates in an extended reticular thalamic activating system (ERTAS), as outlined in work by Baars, Newman, Taylor, Llinas, Engels, and many others who have looked to define thalamocortical interactions and the role of the extended RAS in priming, facilitating and binding cortical function. Particular attention will be paid to the "framing" and "streaming" of working memory and its possible neural substrates in an "ERTAS." This "ERTAS" system is very highly distributed from top to bottom of the neuroaxis, suggesting that consciousness is dependent on a very complex field of brainstem-midbrain-thalamocortical interactions, and that the more ventral portions of this system are absolutely crucial and generally neglected in consciousness theory.

3) Controversy about whether the notion of a "limbic system" has meaning or heuristic value in view of recent work suggesting that the hippocampus is more allied with cognition functions (spatial-temporal mappings), and that therefore there is little basis for assuming any neural integration in popular notions about a "limbic system." However, there may be much more ventral than dorsal integration of the "limbic system," with multiple systems in diencephalon and basal forebrain that support various prototype emotions all projecting to periaqueductal gray (PAG). PAG in turn has very rich connectivities into several key portions of the "ERTAS," suggesting a prominent role for value operators in bootstrapping consciousness. At every level of ERTAS, there are rich interactions with hierarchically distributed "limbic" structures, from paleocortex to basal forebrain, to midbrain PAG. This suggests that the more dorsal cognitive architecture of ERTAS and a ventral limbic architecture for affect are not separable at all. Indeed, severe damage to either the top of this hierarchical system for emotion (the cingulate) or the bottom (PAG) produces profound deficits in consciousness (delirium, stupor, akinetic mutism, or profound twilight states).

4) Possible neural substrates for a primitive representation of the self in connectivities between primitive sensory (superior colliculus, cuneiform nucleus), primitive motor (deep tectal-tegmental motor regions) and primitive value mappings (PAG) (Panksepp).

5) These connectivities between the extended networks of ERTAS and various midbrain systems may form important substrates for the functional interdependence of attention, executive functions, self-representation, and emotion, as basic global state functions essential to consciousness. These primitive midbrain systems have considerable re-entry with the extended prefrontal systems that elaborate volition and self.

6) Basic controversies and unresolved questions about emotion and consciousness and possible empirical tests.

1. Baars, B.J., Newman, J. & Taylor, J.G. (1998) Neuronal mechanisms of consciousness: A relational global workspace framework. In S. Hammeroff et al. (Eds.) *Towards a Science of Consciousness*. Cambridge, MA: MIT Press.
2. Damasio, A. (1994) *Descartes' Error: Emotion, Reason, and the Human Brain*. New York: Avon Press.
3. Damasio, A. (1998) Emotion in the perspective of an integrated nervous system. *Brain Research Review*. May; 26 (2-3): 83-86.
4. Engel, Andreas K., Fries, P., Roelfsema, P., R., König, P. & Singer, W. (1997) Temporal Binding, Binocular Rivalry, and Consciousness. Association for the Scientific Study of Consciousness. On Line E-Seminar, <http://server.phil.vt.edu/assc/esem3.html>.
5. LeDoux, J. (1996). *The Emotional Brain. The Mysterious Underpinnings Of Emotional Life*. New York: Simon and Schuster.
6. Newman, J. (1997) Putting the puzzle together: Towards a general theory of the neural correlates of consciousness. *Journal of Consciousness Studies*, 4:1&2, 47-66, 101-121.
7. Panksepp, J. (1998) *Affective Neuroscience*. Oxford University Press.
8. Smythies, John. (1997) The functional neuroanatomy of awareness. *Consciousness and Cognition*, 6, 455-481.
9. Watt, D.F. Implications of affective neuroscience for extended reticular thalamic activating system theories of consciousness. Association for the Scientific Study of Consciousness. On Line E-Seminar. <http://server.phil.vt.edu/assc/esem4.html>.

### **Efference, Agency, and Phenomenal Unity of Consciousness**

Ralph D. Ellis

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Atlanta GA 30314 USA.

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Natika Newton

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I. This workshop explores implications for the conscious experience of self-unity of recent studies of motor action, the dynamic interdependence of action and perception, and efferent/afferent interrelations both within the central nervous system and between it and the environment.

II. Both presenters have backgrounds incorporating philosophy of mind and neuroscience. They are collaborating on an anthology of emotion, motivation and consciousness with original articles by well-known researchers in philosophy, cognitive psychology, and the neurosciences. (See bibliography)

III. S.Hurley, among many others, has drawn attention to the interdependence of efference and afference and to the influence of emotionally motivated motor intentions on conscious perception. This part of the workshop explores what is known about perception and action mechanisms, subpersonal implementation mechanisms, and feedback systems interrelating them.

IV. The experience of unity of the conscious self with the

content of consciousness has not been an issue recently (as it was for, e.g. Kant and Sartre). We have three proposals:  
(A) Phenomenal unity requires a sense of agency, not reducible to the content of consciousness. A sense of agency would include the experience of "free will."  
(B)The sense of agency is mediated by efference copy as well as motor and perceptual feedback. The "whole person" feels in charge of what's going on through its conscious intentions, and is not just the passive experiencer (even if conceptualized as a single entity).  
(C)The "out-thereness" of phenomenal consciousness, possibly the essence of the "hard problem", becomes surprisingly more accessible to analysis given the above account of the unity of consciousness.

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### **Binding and the Unity of Conscious Perception: Current Research and Thinking**

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One of the central problems of a science of consciousness is how the unity we experience in awareness arises out of the highly modular and distributed activities of the central nervous system. Is this perceived unity illusory or epiphenomenal, as some have argued, or do specific neural processes serve to impose coherence upon the "pandemonium" of brain activity? The binding problem has become a topic of lively discussion since the discovery of synchronous "40-Hz" or "gamma oscillations" associated with the perception of coherent stimuli in the cat visual cortex. Subsequent research has shown 40-Hz to be tied to the synchronous firing of cell populations across wide areas of the cortex, and to be potentiated by activation of the brain stem reticular formation. Evidence for the correlation of synchronous gamma with conscious awareness in humans has been recently reported as well. These, and many other findings, were the subject of a 1998 ASSC E-Seminar led by Engel & Singer's group, who have done much of the original research. Several e-seminar

participants have subsequently contributed to a special issue of Consciousness and Cognition appearing this Spring, which the presenters of this workshop co-edited. Participants in this workshop would be provided with a comprehensive overview of the latest research and thinking in this fast-evolving and controversial area.

#### **Neurological disorders of consciousness**

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Human consciousness cannot be understood without the biological comprehension of the nature of its disorders. The neurologist's view of consciousness is framed by implicit hypotheses derived from reliable observations of brain structure and function. These hypotheses tend to be top down in nature and cover a broad picture sometimes not yet easily translated into the details of neuroscience. However, they represent heuristics that may be examined in the first steps toward a neurological view of human consciousness. Impaired consciousness may result from focal injuries that induce widespread changes in brain function. The phenomenological aspects of these global disturbances are not homogeneous. In many patients, brain damage is too severe to lead to meaningful recovery as in the vegetative state. In others, the transient or permanent impact of focal lesions reveal the contribution of specific brain systems to the overall conscious state. Global disorders of consciousness include stupor and coma, vegetative states, akinetic mutism, absence and partial complex seizures, delirium, and others.

In this workshop we will (1) explore the neurology of impaired consciousness and detail a taxonomy of disorders of consciousness. (2) Place the neurological diseases in the context of the underlying anatomy and physiology of arousal and 'gating' systems. (3) Examine the role of functional brain imaging in building a neurobiological understanding of disorders of consciousness. This approach will be illustrated by new examples of preserved modular brain function in selected patients in the persistent vegetative state. This methodological approach will be considered in terms of developing an understanding of recovery from various states of impaired consciousness. Implications for the rational design of therapeutic strategies for the problems of impaired perceptual awareness and consciousness will also be discussed.

- I. Global and focal disorders of consciousness: a taxonomy
- II. Role of arousal and gating systems in disorders of consciousness:  
review and discussion of underlying anatomical structures and physiological properties.
- III. Functional brain imaging in the persistent vegetative state: isolated modular function in permanent unconsciousness

1. Menon, D.K., et al. (1998) Cortical processing in the vegetative state. *The Lancet* 352, 200

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#### **Change Detection, Attention, and the Contents of Awareness**

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This workshop will examine recent evidence from the study of change blindness: the surprising finding that people fail to notice large changes to natural scenes. Such findings are particularly striking in the face of metacognition about change detection. People feel that they would detect such changes despite the fact that they rarely do. Such impressions are founded on the intuitive belief that we represent the details of our visual world. Yet, recent evidence that people fail to notice large changes to images of natural scenes across eye movements, blank screens, movie cuts, and real world occlusion events suggests that we may not.

We will review the conclusions that can be drawn from change blindness and from related phenomena. Specifically, we consider what these phenomena can tell us about the structure and accessibility of our representations. In so doing, we will also examine recent evidence that change blindness may simply indicate our lack of awareness of the representations we do have. In other words, non-conscious, implicit representations of the details of scenes may at least partially underlie our experience of a stable, continuous visual world. We will also discuss how the techniques used to study change detection may help to determine the role of attention and effort in the formation of both conscious and non-conscious representations. At the end of the workshop, we will consider how the mechanisms underlying change blindness and change detection work together to provide a continuous, stable impression of our visual world.

The workshop will be segmented roughly as follows:

- Hour 1: The phenomena and issues: history and current status
- Hour 2: Representations, attention, and awareness
- Hour 3: Representations, inattention, and non-awareness

#### Readings

##### INATTENTIONAL BLINDNESS:

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- Moore, C. M., & Egeth, H. (1997). Perception without attention: Evidence of grouping under conditions of inattention. *Journal of Experimental Psychology: Human Perception & Performance*, 23(2), 339-352.

##### CHANGE BLINDNESS:

- Rensink, R. A., O'Regan, J. K., & Clark, J. J. (1997). To see or not to see: The need for attention to perceive changes in scenes. *Psychological Science*, 8, 368-373.
- Simons, D. J., & Levin, D. T. (1997). Change blindness. *Trends in Cognitive Sciences*, 1(7), 261-267.

#### The Neurochemical Basis of Consciousness and Sense of Self

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Recently considerable advances have been made in the field of the neurochemical basis of consciousness and self. It would therefore be timely to have a workshop on this topic. The subjects planned would include:

1. the mode of action of general anesthetics particularly on the glutamate and GABA systems.
2. details of the neurochemistry associated with various types of metabolic comas.
3. an exploration of the mechanism of action involved in the deep and prolonged coma produced in humans by a mixture of the iron chelator desferrioxamine and prochlorperazine.
4. the key mechanisms at the glutamate synapse complex for the maintenance of consciousness that include the redox balance between a variety of reactive oxygen species and antioxidants; catecholamine-iron complexes, endocytosis of receptor-transmitter complexes for G-protein linked receptors, blood ammonia and GABA levels, and others.
5. the biochemical mechanisms responsible for changes in the sense of self induced by psychedelic drugs.
6. Attention will also be paid to the basic biochemical

mechanisms controlling synaptic plasticity, neurocomputation, and learning.

These topics are not only of great and timely interest from the point of view of basic brain neurochemistry but they serve to emphasize the biochemical mechanisms that enable neurons to produce conscious states, in a field that here-to-now has been dominated largely by purely electrophysiological considerations.

#### Readings:

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- Smythies, J.R. (1999) Redox mechanisms at the glutamate synapse and their significance. *Eur. J. Pharmacol.* in the press.

## **PLENARY SESSIONS**

**What is Autonoetic Consciousness Good For?** Endel Tulving, Rotman Research Institute  
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Autonoetic consciousness is the form of consciousness that allows human beings to become aware of subjective time and happenings in it. It plays an obligatory role in the episodic, and no other, memory system. Individuals who possess autonoetic consciousness are capable of mental time travel, into the past as well as into the future. Evidence for the unique properties of autonoetic consciousness has been provided by cognitive and psychopharmacological experiments with normal subjects, neuropsychological studies of patients with brain damage, functional neuroimaging (PET) studies, and event-related potential (ERP) studies. Prefrontal cortical and temporal polar regions play a prominent role in the operations of autonoetic consciousness.

This lecture is concerned with the issue of biological utility of autonoetic consciousness. What is it good for? Given the apparent fact that even in all of human activity it seems to play only a minor role, why did autonoetic consciousness evolve?

I propose that the CONSCIOUSLY APPREHENDED AWARENESS OF THE EXISTENCE OF FUTURE, a feature of autonoetic consciousness, initially was responsible for triggering, and subsequently continuing to enable, the evolution of culture. This proposal of "coevolution of autonoesis and culture" is predicated on the hypothesis that only those creatures that are capable of "THINKING FUTURE," mentally apprehending time as permanent, and who appreciate their own and their progeny's continuation in time, are likely to deliberately invent, preserve, and refine the implements and artifacts that transform an inhospitable natural environment into a more stable world.

**The role of the prefrontal cortex in the monitoring of mnemonic processes.** Michael Petrides, Cognitive Neuroscience Unit, Montreal Neurological Institute, McGill University, 1205 Dr. Penfield Ave, Montreal, PQ H3A 1B1, Canada.  
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Studies of patients with lesions of the prefrontal cortex and monkeys with selective prefrontal lesions, as well as studies with functional neuroimaging techniques in normal human subjects, have demonstrated that the mid-dorsolateral part of the prefrontal cortex is critical for the monitoring of information within working memory. Although the short- and long-term maintenance of information can be normal after lesions limited to this part of the prefrontal cortex, performance is severely impaired when the memory tasks challenge the capacity to monitor

the information within working memory. It is argued that the evolution of the mid-dorsolateral part of the prefrontal cortex in the primate brain was not for the short-term maintenance of information, but rather for the capacity to monitor and manipulate cognitive representations of intended or expected acts or events. This capacity for the active monitoring of one's mnemonic processing, which appears to depend on interactions between the mid-dorsolateral prefrontal cortex and posterior cortical regions, is essential for high-level planning of behaviour.

**A comparison/contrast between a psychological metacognitive view and David Rosenthal's philosophical ideas about consciousness.** Tom Nelson, Department of Psychology, University of Maryland, College Park, MD 20742, USA.  
[tnelson@glue.umd.edu](mailto:tnelson@glue.umd.edu)

This talk will describe the author's opinion of some of the relationships between psychological research (on metacognition) and the recent philosophical views of David Rosenthal concerning consciousness.

**Consciousness and Metacognition.** David Rosenthal, Cognitive Science, Box 520 CUNY Graduate School and University Centre, 33 West 42<sup>nd</sup> Street, New York, NY, 10036-8099, USA.  
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I'll discuss recent research about metacognition, with special attention to work by T. O. Nelson, in connection with the question of what it is for a mental state to be a conscious state. In particular, I'll suggest ways in which results about metacognition support the hypothesis I have elsewhere put forward on which a mental state is conscious if it is accompanied by a noninferential higher-order thought to the effect that one is in that state.

**Attending to other people's mental states.** Alan M. Leslie, Centre for Cognitive Science, Rutgers University, Busch Campus, Piscataway, N.J., 08854, USA.  
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We begin attending to mental states very early in life. How can the young brain attend to such states which can't seen, heard, or felt? I will outline an answer in terms of the Theory of Mind Mechanism (ToMM), a specialized, perhaps modular, mechanism whose job is to attend to the mental states of other people. It appears to be specifically damaged in the neurodevelopmental disorder of autism. ToMM has important but limited powers. One limitation is made manifest when young children attend to false beliefs. This limitation is circumvented by inhibitory executive processes which develop slowly in comparison with ToMM.

**The Mirror Test.** Gordon G. Gallup, Jr., Department of Psychology, State University of New York at Albany, 1400 Washington Ave, Albany, N.Y., 12222-0001, USA.  
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The literature and logic behind the mirror test as a measure self-recognition in humans and animals will be reviewed in some detail. Despite the use of many different experimental strategies employed over a period of thirty years, only three species (chimpanzees, orangutans, and humans) have shown compelling, reproducible evidence of being able to correctly decipher mirrored information about themselves. Some of the cognitive implications of this capacity as it may relate to the evolution of self-awareness, conscious, and mind will be discussed.

**Neurones that perceive faces: Face Perception and responses of brain cells.** Dave Perrett and Christian Keysers, School of Psychology, University of St Andrews, St Andrews, Fife, KY16 9JU, UK.  
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This paper reviews the properties of cells in one brain area (STSa) that respond selectively to the sight of faces and their relation to visual experience. Under some viewing conditions (e.g. inversion) faces are perceived more slowly. We found that a slowing of the neural responses to these faces parallels this slowing of perception. Under conditions of binocular rivalry (when a face is presented to the left eye and a star pattern to the right eye) perception alternates: at one moment a face is seen and another a star is seen. Logothetis et al. finds that behavioural report parallels activity in temporal cortex but not in earlier visual areas. Such findings lead several authors to suggest that the firing of cells in STS might lead to the conscious perception of the object the cells represent. Our studies, however, show that STS cell firing can occur in situations where no visual awareness results. We have studied a population of cells that commence response when the experimenter moves behind an occluding screen. Such responses continue while the face can no longer be perceived. In this situation, the cells firing may convey the knowledge that the object still exists behind the screen, without creating the vivid awareness of seeing the object as if the screen was made of glass. In a second situation images were presented in sequences too rapid for visual awareness of individual images. Nevertheless, many STS cells fired selectively to individual images in the sequences, indicating that again firing does not always result in consciousness.

**The knowledge of the internal activities of conscious minds: a neurophysiological perspective.** Giacomo Rizzolatti, Istituto di Fisiologia Umana, Universita di Parma, Via Gramsci, 14, I-43100 Parma, Italy.  
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The only thing that a brain knows is the discharge of its neurons. This discharge can give information on the

external world or to be caused by the internal states of the organism. There are two views on the epistemological primacy of these two information sources. The traditional philosophical view is that an individual knows first and best himself. Our knowledge of ourselves is immediate, direct, and devoid of errors. This view, however, is rather difficult to reconcile with the fact that the brain evolved in order to control the external world rather than to meditate on itself.

On the basis of neurophysiological studies I will submit that the neural patterns on the basis of goal-directed actions have both these apparently contrasting properties: they are immediately given, their aim is to control the external world. To illustrate this proposal I will review, first, the properties of a particular set of neurons, located in the ventral premotor cortex of the monkey (area F5), that discharge during goal-directed actions. I will describe then another set of neurons also located in F5, the "mirror neurons". These neurons discharge both when the monkey makes a particular action and when it observes another individual (monkey or human) making a similar action. I will argue that mirror neurons are at basis of understanding of actions made by others.

I will conclude by proposing that the capacity to plan actions (in contrast to an immediate stimulus-driven motor response) and to correlate the corresponding neural pattern with the performed action has been fundamental for segregating the self from the rest of the world. The subsequent evolutionary step crucial in leading to self-consciousness was the necessity (and capacity) to discriminate motor patterns corresponding to action generated by the acting individual from those generated by actions made by other individuals.

**Apparent Mental Causation: Sources of the Illusion of Conscious Will.** Daniel M. Wegner and Thalia P. Wheatley, Department of Psychology, Gilmer Hall, University of Virginia, Charlottesville, VA 22903, USA.  
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Hume described the will as nothing but the internal impression we feel and are conscious of, when we knowingly give rise to any new motion of our body, or new perception of our mind. But this sense that we consciously cause our own voluntary actions is something that varies in everyday life. Conscious will can indeed be lost entirely under certain conditions, as in hypnosis, channeling, spirit possession, dissociative identity disorder, and in motor automatisms such as Ouija board spelling, automatic writing, dowsing, table turning, and the like. Such automatisms suggest that the experience of will is a variable quantity that can be added to or subtracted from voluntary action.

A theory of *apparent mental causation* is proposed to account for the experience of will. According to this theory, the experience of consciously willing an act arises from interpreting one's thought as the cause of the act. Conscious will is thus experienced as a function of the priority, consistency, and exclusivity of the thought about

the action. The thought must occur before the action, be consistent with the action, and not be accompanied by other causes. Our experiments illustrating the role of priority found that people can arrive at the mistaken belief that they have intentionally caused an action that in fact they were forced to perform--when they are simply led to think about the action just before its occurrence.

**Phenomenal Volition and Agenthood: An Application for the Self-Model Theory of Subjectivity.** Thomas Metzinger, Hanse Institute for Advanced Study at Bremen, Germany.  
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At last year's ASSC-conference in Bremen I presented an outline of the "Self-model Theory of Subjectivity" (Metzinger 1993), a conceptual model about how an experiential first-person perspective can emerge within an information processing system like the human brain. This year I will apply this model to two specific classes of phenomenal content: Occurrent episodes of phenomenal volition and the subjective, experiential property of agenthood. As usual, I will first try to analyze both forms of conscious content as special types of "representational" content. Then I will use a coarse-grained "functional" analysis to look at the causal role that the activation of these states plays within the system. In doing so, I will also try to interpret some new empirical evidence from a philosophical perspective. If time allows, I will conclude by making a brief attempt to connect the current debate to classical issues concerning the freedom of the will.

**Interactions between face and self revealed by personal accounts of facial difference.** Jonathan Cole, Clinical Neurological Sciences, University of Southampton, Southampton, SO16 6YD, UK  
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The intimate relation between face and self is, perhaps, revealed most forcefully in the first hand accounts of those with facial difference. People with such problems as facial immobility, facial scarring or mature onset blindness are forced to a consideration of themselves, and their interactions with others, which expose facial function in a manner more conventional empirical studies find difficult, (Cole, 1998).

Those with autistic spectrum disorder may find facial expressions both beyond comprehension and threatening, so potent is the face as a symbol of others. Subjects with late onset blindness have to learn to construct character from voice: 'face,' meaning characterisation of other selves, becomes mainly aural. Those with immobile faces, either due to congenital problems, (Moebius Syndrome), or say, Parkinson's Disease, can describe a reduced emotional intensity consequent to a lack of facial-embodiment, and the affects on social interaction which result. Those with facial disfigurement have their difference reflected in the faces of people they meet each day.

In revealing the importance of social relatedness in the elaboration of sense of self, these first hand accounts show how the teaching of social skills, and the use of other

channels for emotional communication and experience, might help those with facial difference, (see Partridge, 1998).

Cole, J. 'About Face,' The MIT Press, 1998  
Partridge, J. 'Changing Faces: the Challenge of Facial Disfigurement, Penguin 1990; 3rd edition: Changing Faces 1998 ([www.changingfaces.co.uk](http://www.changingfaces.co.uk)).

**Neural correlates of changes in perceptual awareness in the absence of changes in the stimulus.** Nancy Kanwisher, Department of Brain and Cognitive Sciences, MIT, Cambridge, MA 02139, USA.  
[ngk@psyche.mit.edu](mailto:ngk@psyche.mit.edu)

Three phenomena which can produce changes in the contents of perceptual awareness in the absence of any change in the stimulus are visual attention, binocular rivalry, and mental imagery. I will describe work from my lab which uses fMRI to trace the neural correlates of changes in the content of awareness in each of these three situations. Our strategy is to measure neural activation in two different extrastriate regions with well-characterized stimulus-specific response patterns, the fusiform face area (FFA), which responds in a highly selective fashion to faces, and the parahippocampal place area (PPA), which responds selectively to images depicting places. We find clear changes in the neural activity in these two areas when the content of perceptual awareness changes from a face (producing a strong response if the FFA) to a house (producing a strong response in the PPA).

**Face and object recognition: Competition for conscious awareness in agnosia and normal perception.** Morris Moscovitch, University of Toronto and Rotman Research Institute, Baycrest Centre for Geriatric Care, 3560 Bathurst St., North York, ON M6A 2E1, Canada.  
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The series of experiments focuses on a person CK, who has object agnosia and alexia, but normal face-recognition. As a result, we can investigate the properties of the face-recognition system with minimal contamination from the object-recognition system. His performance will be contrasted with that of CM, a person with alexia but intact face and object recognition, and with neurologically-intact controls. The results of the study show that CK's face-recognition is normal only when faces are intact and upright, but impaired if they are inverted or fractured, whereas CM's recognition is normal throughout. Equally interesting is that when viewing upright faces that are made up of objects, such as the fruit faces painted by Arcimboldo, CK, but not CM and controls, is not even aware of the objects that comprise the face. He becomes aware of them once the face is inverted, or his attention is drawn to them. Conversely, CM and controls, but not CK, have difficulty detecting faces that are camouflaged by objects. CK and CM, however, perceive objects and words at a non-conscious level, as indicated by their performance on Stroop tests. Competition between the face and object system for access to conscious awareness seems to account best for these effects.

**Understanding disorders of the awareness of control.**  
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Psychiatric patients with delusions of control make movements that are in accord with their intentions and yet have the experience that these movements are being controlled by alien forces. In contrast neurological patients with the anarchic hand sign have a hand which makes movements which are not in accord with their intentions, yet these patients do not believe that their hand is being controlled by alien forces. To understand these phenomena we need to understand, not only how actions are controlled, but also how we experience the control of action. I shall present an account of motor control which assumes that the brain represents a number of internal states of the motor system including the predicted consequences of movement. These states are estimated through inverse modelling (computing the movements needed to achieve a certain state) and forward modelling (computing the state that will result from a certain sequence of movements). In the normal case we are aware of some, but not all of these internal representations. I shall show how various neurological disorders can be understood in terms of this account of the control system and suggest that delusions of control occur through a failure to represent the predicted consequences of movement. Finally I shall consider the advantage of being aware of controlling our own actions and suggest that this awareness is critical for taking an intentional stance to ourselves and other agents.

**Consciousness of action and self-consciousness.** Marc Jeannerod, Institut des Sciences Cognitives, CNRS UPR 9075, 67 Bld Pinel, 69675 Bron, France  
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A description of how actions are represented, how these representations are built, and how their content can be accessed by the agent and by other agents is critical for understanding how an action is attributed to its proper origin or, in other words, how a subject can make a conscious judgement about who is the agent of that action. This question is central to the problem of self-consciousness: action is one of the main channels used for communication between individuals, so that determining the agent of an action contributes to differentiating the self from other selves. Several psychiatric syndromes, such as schizophrenia, seem to lead to a dysfunction of the awareness of one's own action as well as of recognition of actions performed by others. Such syndromes offer a framework for studying the determinants of agency, the ability to correctly attribute actions to their veridical source. Experiments will be reported, demonstrating that hallucinating and deluded schizophrenic patients are specifically impaired in discriminating their own actions from those of another agent.

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Georgieff, N. & Jeannerod, M. (1998) Beyond consciousness of external events. A "Who" system for consciousness of action and self-consciousness. *Consciousness and Cognition*, 7, 465-477.

## **CONCURRENT SESSIONS 1**

### **1.1 Self-awareness and Higher-order Thought**

(Chair: Jillian McIntosh)

#### **1.1.1 Intersubjective Consciousness and Self- or I-awareness.**

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This paper examines some aspects of the problem of defining the unity and closeness of one temporal stream of consciousness over and against others. It argues that the intersubjective context makes it particularly pressing to clarify the sense in which conscious experiences can be said to belong together, not only as being originally experienced in a temporal continuity, but as being experienced by "me", or as "mine", in contrast to those conscious experiences that are only mirrored in "my" experiences as being experienced by others. Using a contrastive phenomenological analysis of both, an instance of representing an episodic memory of "mine" and an instance of representing an imaginary event involving "myself" versus instances of representing someone else's experiences, the paper aims at clarifying the relationship between possibilities of original experience and I-awareness with regard to conscious experiences.

#### **1.1.2 Implicit Self-Understanding and the Problem of Phenomenal Consciousness**

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It is commonly (and rightly) assumed that reflective or meta-cognitive intentionality plays a major role in our conscious lives. For example, It underlies our ability

- to reason about our plans, goals and knowledge,
- to construct our autobiographical memories, and
- to assess our own mental capacities and limits.

As the examples suggest, it is most often associated with fairly complex personal level abilities; thus it may seem of relevance mostly to what Chalmers has called "the Easy (or at least the Not Really Hard) Problems of consciousness", rather than to the Hard Problem of explaining qualitative phenomenal experience.

However, meta-intentionality, if properly understood, can shed light on those latter puzzles as well. The key move is to expand our sense of what counts as self-understanding well beyond (or better "below") the sort of explicit sophisticated personal level self-understanding found in the standard cases. Much self-understanding is procedurally embedded at a subpropositional level in the structure of the processes that provide the organizational substrate of conscious experience, for example in those that generate the phenomenal manifold of experiential perception from

the integration of sensory input and stored memory. Talk of "understanding" or "self-understanding" at this level is not metaphoric, but concerns a form of meta-intentionality that is genuine though quite different from that found at the personal level.

Many pathologies of consciousness involve cases in which neural damage has caused a loss or distortion of the relevant embedded meta-understanding, leading to deficiencies of conscious experience.

#### **1.1.3 Vehicle Externalism and Higher-Order Monitoring Theories of Consciousness: Is the \*Conscious\* Self outside the head?**

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Although philosophers of mind have disagreed vehemently over the question of whether the mind *\*is\** the brain, they have tended to agree that the mind is *\*in\** the brain. Materialists of all stripes have generally supposed that the physical states which mental states either are, or supervene on, lie exclusively within the skin. Call this assumption *\*vehicle internalism\**. In recent years, a number of theorists have argued in support of *\*vehicle externalism\** - the thesis that some of a human being's mental states can be supported by physical states external to its body.

I distinguish between two forms of vehicle externalism. Weak Vehicle Externalism (WVE) claims that only non-conscious mental states can be supported by external physical states. Strong Vehicle Externalism (SVE) claims that both conscious and non-conscious mental states can be supported by external physical states. Many of those who find WVE fairly intuitive find SVE deeply counter-intuitive. I argue that WVE seems to entail SVE when combined what is arguably the dominant account of consciousness in philosophy at the moment: the Higher-Order Monitoring (HOM) theory of consciousness. The central claim of HOM theories is that a mental state is conscious iff it is monitored (in a certain sort of way) by another mental state of the same subject. I argue that an external mental state can be so monitored, and thus if HOM theories are right, such an external state could also become a conscious state.

I raise but do not settle the question of whether this argument should be taken as a reason to reject either WVE or HOM, or whether it should instead be taken as an argument for SVE.

#### **1.1.4 Relaxing Higher Order Thoughts**

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For all its merits, David Rosenthal's Higher Order Thought (HOT) theory of consciousness should and can be

broadened and relaxed. As it now stands, it heavily relies on the argument from reportability: "The dispositional reportability of a conscious mental state can only be explained by the fact that the mental state is nondispositionally accompanied by a HOT that one is in that state."

Besides reportability, there are other roles of conscious mental states that can yield arguments for a HOT theory. Among these are memorability, single trial learnability and 'poisedness for action'. This last property leads to the following argument: "The dispositional poisedness for action of a conscious mental state can only be explained by the fact that the mental state is nondispositionally accompanied by a higher order thought that one is in that state."

But broadening the scope of the HOT theory cannot happen within the original rigid construal of it. The notion of HOT should be relaxed as implying nothing more than: -that the first order content be represented in a 'proto-conceptual' format -that the second order ingredient contains some kind of self-concept. The relaxed HOT theory can be linked to neuroscience. In particular, Milner and Goodale's distinction between a nonconscious visual system for the on-line control of action and a conscious one for experience can be understood as the difference between a system that does not involve HOT's and one that does.

1. Milner, A.D. & Goodale, M. A., *The Visual Brain in Action*, Oxford UP, 1995.
2. Rosenthal, D. M. (1993), "Thinking that One Thinks", in Davies, Martin & Humphreys, G.W. (1993), eds., *Consciousness*, Oxford: Blackwell.

## 1.2 Attention and Imagery (Chair: Keith Humphrey)

### 1.2.1 Link Between Brain Learning, Attention, And Consciousness.

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The processes whereby our brains continue to learn about a changing world in a stable fashion throughout life are proposed to lead to conscious experiences. These processes include the learning of top-down expectations, the matching of these expectations against bottom-up data, the focusing of attention upon the expected clusters of information, and the development of resonant states between bottom-up and top-down processes as they reach an attentive consensus between what is expected and what is there in the outside world. It is suggested that all conscious states in the brain are resonant states, and that these resonant states trigger learning of sensory and cognitive representations. Illustrative psychophysical and neurobiological data are presented from early vision, visual object recognition, auditory streaming, and speech perception, among others. It is noted how these

mechanisms seem to be realized by known laminar circuits of sensory and cognitive neocortex. It is suggested that sensory and cognitive processing in the What processing stream of the brain obey top-down matching and learning laws that are often complementary to those used for spatial and motor processing in the brain's Where/How processing stream. This enables sensory and cognitive representations to maintain their stability as we learn more about the world, while allowing spatial and motor representations to forget learned maps and gains that are no longer appropriate as our bodies develop and grow from infancy to adulthood. Procedural memories are proposed to be unconscious because the inhibitory matching process that supports these spatial and motor processes cannot lead to resonance.

### 1.2.2 Capacity Limits In Change Blindness Estimated Using Psychophysical Stimuli

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An experimental methodology known as Change Blindness (CB) has come to prominence in the last five years. A typical CB experiment involves presenting subjects with a naturalistic scene, followed by a brief blank screen, then a second scene that differs in some way from the first, followed by a second blank screen. This sequence is repeated until subjects report perceiving a change. Observers typically find it very difficult to notice even what would appear to be highly salient changes between scenes (e.g. the heads of two central characters being swapped). This difficulty in detecting change is thought to reflect a capacity limit in selective attention.

Using a change blindness methodology, subjects were presented with arrays of multi-coloured disks. In 50% of trials each time an array was blanked one of the colours was changed (on the remaining 50% of trials no change occurred). The capacity estimate obtained suggests that subjects are able to selectively attend to approximately 4 colours. This number is significantly less than that obtained in a related series of experiments studying visual short-term memory (where capacity was estimated to be 6.5 colours). Further experiments suggest that this difference is caused by the different instruction set used in each type of experiment (i.e. whether subjects were asked to report when they "perceived a change" (CB experiments), or in a yes/no manner whether a change has occurred (VSTM experiments)).

Results suggest that observers rely on two distinct sources of information when reporting whether a change has occurred. One source, limited to approximately 4 items, contains information about the nature of the object changing (e.g. its colour and location); while the other, limited to about 6.5 items, appears to only contain information that a change has occurred, with no information about the nature of the change itself.

### **1.2.3 Voluntary Control Of Negative Afterimage**

#### **Fragmentation**

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The fading of a structurely complex afterimage from visual awareness often proceeds orderly, wherein its pieces disappear and reappear (in fainter forms) for several cycles, before it completely disappears (Evens, 1965). Similar phenomena were also known to occur when stabilized retinal images fade from awareness (Prichard, 1961). In a series of experiments, the role of voluntary attention in afterimage fragmentation was investigated. Observers kept staring steadily at a display composed of superimposed geometric line figures in two opponent colors. After one minute or so, the entire display was covered with a plain gray color, and observers were instructed to perceive the afterimage as one figure in front of the other, using color as the cue for image segregation. Typically, the front figure fades from awareness earlier, even the observers had been made to believe the opposite. During the fragmentation process, most observers felt being able to "extinguish" a selected component figure from awareness at will. As the retinal position of an afterimage remains constant despite of fixation shifts, these findings provide stronger support than previous ones (Lou, in press) for the view that covert voluntary attention can expedite visual sensory adaptation.

### **1.2.4 Interfering With Imagery**

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Distressing, vivid images are a common feature of conditions such as post-traumatic stress disorder, yet laboratory research into mental imagery rarely focuses on the subjective, experiential aspects of imagery. Baddeley & Andrade (1998) argued that vivid imagery results from maintenance of detailed sensory information in working memory. Interfering with the verbal and visuo-spatial slave systems of working memory reduced self-reported vividness of auditory and visual images respectively. We extended this research to the clinical problem of traumatic imagery. We hypothesised that interfering with visuo-spatial working memory would reduce the vividness of concurrent visual images and the strength of emotion associated with them. Analogue studies with undergraduates supported this hypothesis and showed that although visuo-spatial interference reduced distress during repeated imaginal exposures to emotive stimuli, it did not impede long-term habituation of the emotional response to those stimuli. Interfering with the conscious experience of an image may reduce the immediate emotional response but some underlying emotional processes must remain unaffected. Visuo-spatial tasks may thus be useful for manipulating conscious experience in clinical therapy, in that they may reduce the unpleasantness of imaginal exposure without reducing its efficacy.

### **1.3 Brain Imaging and Neurochemistry**

(Chair: Antti Revonsuo)

#### **1.3.1 Can Functional Brain Imaging Discover Consciousness In The Brain?**

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Biological discoveries are typically very much dependent on the capabilities of available research instruments to acquire and visualize data from otherwise unobservable levels of biological organization. If we assume that consciousness is a natural biological phenomenon in the brain, should we expect the current brain sensing and imaging methods to somehow "discover" consciousness in the brain? The answer depends on the following points: What kind of level of biological organization do we assume consciousness to be? What are the levels of organization from which our research instruments pick signals and acquire data? Do we have modelling and visualization techniques that could help us to reconstruct a meaningful description of the relevant levels of biological organization from the acquired data?

I shall assume that the level of organization at which consciousness resides might be a highly organized macro-level electrophysiological phenomenon in the brain, realized by the coordinated electrical activity of specific neural populations whose precise nature and location is at present largely unknown. In the light of this assumption, we can evaluate the current brain sensing and imaging methods as to their capability of revealing levels of organization in the brain directly involved in the realization of consciousness. Single-cell recordings, PET, fMRI, EEG and MEG pick different types of signals from different levels of organization in the brain. However, it seems they do not manage to pick signals that would allow the reconstruction and visualization of the higher levels of electrophysiological organization, assumed to be critical for an explanation of consciousness. Therefore it is unlikely that we could uncover the direct biological basis of consciousness by using these research instruments alone

#### **1.3.2 fMRI of Semantic Incongruence in the Implicit Association Test**

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The implicit association test (IAT), is a technique for measuring implicit attitudes<sup>1</sup>. Participants rapidly classify items into one of four categories by selecting one of two responses and perform better when congruent categories (flower, pleasant) share the same response than when incongruent categories (insect,pleasant) are mapped to the same response.

Each one of 8 participants classified consonant strings (perceptual control) for case using a mouse. Next they classified 20 nouns as pleasant/unpleasant. After another perceptual block, they classified another 20 nouns as flower/insect. This sequence was repeated once. Participants were thus trained on responses mappings, but while being scanned, they made flower/insect and pleasant/unpleasant decisions on alternating trials. A block of word classification lasting 30 seconds was alternated with a 20 second control block. This fMRI run was run twice in both the congruent and incongruent conditions. fMRI was performed on a 2.0T Bruker system using a gradient echo EPI sequence covering the cerebral cortex in 17 oblique axial slices. Activations in the IAT conditions were compared to perceptual control. Data were analyzed for location and spatial extent of activation.

On practice trials, performance on the congruent and incongruent conditions was comparable. However, during scanning, the incongruent condition was characterized by slower responses and reduced accuracy. There was dramatically greater activation of the left prefrontal cortex (BA 9; -40, 14,30 ) in the incongruent condition. It was more striking when the congruent condition preceded the incongruent condition . Contrasting activations that were less robust were also observed in bilateral superior parietal areas (BA7; 5/8) and SMA (4/8).

Executive resolution is central to Stroop task conditions involving conflicting processing streams and activate the anterior cingulate gyrus<sup>2,3</sup>. The activation in the incongruent IAT reflects processing engaged to suppress the impact of implicit associations on response selection.

Greenwald, A. E., McGhee, D. E., & Schwartz, J.L.K. J Pers & Soc Psych 1998, 74:1464-1480.  
Posner, M. I., & DiGirolamo, G.J. In The Attentive Brain, Parasuraman, R. Ed., 1998, 401-423.  
Bush et al.; Hum Brain Mapping 1998; 6:270-282

### **1.3.3 Evidence That Self- Face Recognition Is Correlated With Right Hemisphere Activity: An Overview Of Recent Neuroimaging Investigations**

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The capacity for self- awareness (SA) has been tested in humans, chimpanzees, and orangutans by use of the mirror self- recognition test. While numerous researchers have speculated that this ability may be correlated with right prefrontal activity, determining the cortical networks involved in SA is far from complete. To investigate the cortical correlates of SA, the original mirror test was modified for use in psychophysical and neurological investigations. Pilot studies employing functional magnetic resonance imaging found that when subjects viewed their own face, an area in the right prefrontal cortex (RPFC) was preferentially activated when compared with viewing

famous faces. Using a reaction time task, it was found that self-faces were identified more rapidly than non- self faces when subjects responded with their left hand. Subjects were also more likely to identify a picture as their own face when responding with their left hand under several face morphing paradigms. Evoked potential and electroencephalograph data indicated that the right frontal lobe is preferentially activated under conditions of self- images. Repetitive transcranial magnetic stimulation (rTMS) delivered at 1 Hz to the RPFC enhanced self- identification. Further investigations revealed that when motor event potentials are examined during self- processing, the right hemisphere appears to have an increase in excitation. Also patients undergoing WADA procedures have difficulty recalling mirror and self- face presentation when the right hemisphere is anesthetized. These results indicate that self- recognition, which is likely an underlying component of SA, may be correlated with cortical activity in the RPFC.

### **1.3.4 The Neurochemical Bases Of Consciousness**

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The study of the neural basis of consciousness has been based up to now mainly on neuroimaging, neurophysiological and psychophysical methods. This presentation will be a review of what is known about the neurochemical factors involved in consciousness. This covers (i) the model of action of general anesthetics, mainly on the brain glutamate/GABA systems (ii) a survey of several comas of metabolic origin and (iii) the coma caused by depletion of intraneuronal iron levels. This will include a discussion of the biochemical mechanisms concerned in glutamate synapse function with particular regard to the redox mechanisms involved, i.e., the balance between neurodestructive reactive oxygen and reactive nitrogen species on the one hand and protective antioxidants on the other. I will also discuss the role of dopamine as an antioxidant, the role of endocytotic mechanisms, the endosome system, protein triage systems, and a key role for intraneuronal dopamine-iron complexes as scavengers of superoxide anions.

## **1.4 Varieties of Memory**

(Chair: William Banks)

### **1.4.1 Explicit Memory in Rhesus Macaques.**

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Humans with amnesia cannot form new conscious, explicit memories, while implicit memory is left intact. A technique

for making the distinction between implicit and explicit processes in animals has recently become available (Inman & Shettleworth, 1996; Smith et al., 1998), and was adapted for use with monkeys (*Macaca mulatta*) in a match to sample task. At the start of each trial the animals studied a picture, and a delay followed. On 2/3 of trials the monkeys chose between taking a memory test or escaping from the test. On 1/3 of trials the monkey is only given the option of taking the test. The two monkeys tested were more accurate when they chose to take tests than when they had no choice about taking tests, indicating that they adaptively escaped from trials on which they had forgotten the picture. In order to rule out the use of cues other than the absence of a memory for the picture in controlling the escape response, monkeys were presented with occasional probe trials on which no picture was presented for study. Since no picture entered the animals memory on these trials, they should treat them like trials on which they had forgotten the picture. The monkeys were much more likely to escape on trials where no picture had been presented than they were to escape from normal trials. These results suggest that monkeys know whether or not they remember a recently seen stimulus - a form of explicit memory.

#### **1.4.2 False Fame And Recognition Memory Predicted Without Unconscious Components**

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Is recognition memory a sum of conscious and unconscious components? The process dissociation paradigm extracts a conscious and an unconscious component from recognition by comparing unconstrained recognition (inclusion) performance with exclusion performance, which is recognition in which only specified old items are to be correct targets. False recognition of excluded items is considered evidence for an unconscious familiarity component. The present analysis plots memory tasks in a multidimensional signal-detection space. Recognition memory, source memory, and exclusion performance are separately predicted as different projections onto a unidimensional decision axis in this spatial representation.

This presentation shows how to generate a multidimensional signal-detection representation and make predictions for each of these paradigms using decision axes drawn through the space. The detection model is simpler than the comparable multinomial model, it is more easily generalized, and it does not make threshold assumptions. An experiment using a single memory set for all three tasks demonstrates the analysis and tests the model. The results show, among other things, that the evidence for unconscious influences on memory can be predicted from the representation, which has no specific unconscious component. The analysis is extended to false fame judgments, which can be explained as resulting from an oblique decision axis without assuming separate familiarity and recollection components.

#### **1.4.3 Ventral Prefrontal Contributions To Autonoetic Awareness And Self-Regulation**

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Re-experiencing the past and envisioning oneself in the future are among the most advanced accomplishments of human consciousness. These abilities, which correspond to Tulving's notion of autonoetic awareness, enable the self-regulation of behavior in unstructured situations in which habit or environmental signals oppose adaptive decision making. Autonoetic awareness is mediated by the frontal lobes, especially the ventral regions that are involved in limbic processing of rewards and punishments.

Until recently, empirical validation of these hypotheses has been elusive. In this presentation, research findings bearing on these hypotheses will be presented. These data are drawn from studies of patients with frontal lobe brain disease and healthy adults using the remember/know technique, analysis of autobiographical memory, laboratory tests of strategic self-regulation and decision making, and measures of psychosocial outcome. The role of inhibition in self-regulation, as assessed by working memory tasks sensitive to ventral prefrontal lesions in the monkey, will also be discussed.

#### **1.4.4 Variance Rather than Strength is Important for Metacognition**

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An important aspect of consciousness and metacognition is to rejects items not present at study in a recognition test. Studies of false memories suggests that items from a difficult class (e.g., high frequency words) have a larger proportion false memories than items from an easy class (e.g., low frequency words), a phenomenon called the mirror effect. The variance theory is proposed as an explanation for the mirror effect. It predicts that the variance of the net input to nodes increases when items are presented in different contexts yielding a linear increasing variance as a function of frequency whereas the expected strength of the net inputs are equal for the two classes. The higher variance yields lower hit rates and higher false alarm rates for low frequency items than for high frequency items. Experimental data supports the prediction that focusing attention to the more difficult class affects the hit rate but not the false alarm rate and not the standard deviations of the underlying distributions leading to no mirror effect, whereas the attention-liability theory (Glanzer, Adams, & Kim, 1993) predicts a mirror effect. Furthermore, the theory does not require subjects to differentiate between the classes of stimuli and accounts for receiver operating characteristic curves. The variance theory is simulated in a distributed neural network model. Implications for distributed neural models of memory is discussed.

## **CONCURRENT SESSIONS 2**

### **2.1 Explanatory Gap**

(Chair: Jillian McIntosh)

#### **2.1.1 Kripke and the Illusion of Contingent Identity.**

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Saul Kripke's (1971, 1972) modal essentialist argument against materialism remains an obstacle to any prospective Identity Theorist. The standard way for materialists to avoid Kripke's conclusion is to deny, on the grounds that the theory does not specify identities using rigid designators, that Kripke's argument applies to the theory in question (e.g., Lycan 1987). This response may be used by functionalists, but it is not available (at least not readily so) to the Identity Theorist. This paper is an attempt to make room for an Identity Theory without dismissing Kripke's analytic tools or essentialist intuitions. I briefly review Kripke's argument and its application to the Identity Theory. I then propose an explanatory model that can make room for the Identity Theory within the constraints of Kripke's view; the model is based on ideas from Alan Sidelle's, "Identity and Identity-like" (1992). My model explains away the apparent contingency of mind-brain identities by appealing to our epistemic access to conditions of identity and individuation of sensations and brain processes, respectively. I support my proposal by indicating how it agrees with the current status of neuroscientific theory, and how it could address philosophical concerns such as Joe Levine's explanatory gap argument.

#### **2.1.2 Why is it so hard to give a positive and informative account of phenomenal consciousness and qualia?**

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Some philosophers claim that there is nothing we know more intimately than qualia, or the qualitative contents of experience. Ironically, notions like qualia have turned out to be notoriously hard to account for. The well-known difficulties with reduction aside, it still remains a problem to give an adequate analysis of what qualia are.

Philosophical notions of subjectivity seem very hard to verbalise in any informative vocabulary and alternative expressions like "points of view" and "what-it-is-like" tend to be at least as obscure as the original definiendum. The fact that phenomenal qualities "obviously exist" but resist all non-circular descriptions may seem to be a good reason for regarding them as explanatory fundamental (see Chalmers 1996).

In this presentation, I will try to show that taking qualia as fundamental reflects a misconception about the phenomenal as a category. Qualia, as described by

philosophers, are not equivalent to the contents of ordinary experience, but are abstractions from ordinary experience. I will question the legitimacy of such abstractions if the resulting concept becomes a mere negation of "physical" with no other positive characteristics than a reference to some "undeniable" feature of experience. If I am right, "qualia" is not a sound descriptive category but rather functions as a contrast notion, although the term may still appear to be descriptive due to its assumed reference to plain experience.

#### **2.1.3 Phenomenal Conscious And Godel's Theorem (Or: What Mary Could Know About You That You Couldn't Know)**

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This paper argues that the common perceptual metaphor for conscious experience has led to hopeless confusion, and that the only solution is to substitute an action metaphor. It is shown that the intractability of the Knowledge Problem is a result of the perceptual metaphor, which leads to confusion about what a conscious subject, and what an objective scientific observer, can know about the subject's consciousness. It is concluded that a scientific observer must always know more objective facts about a subject's conscious state than that subject can be aware of while in that state. It is also argued that the subject has an experience of agency, while performing conscious activity, that is an aspect of the activity itself and is not a fact about the physical world.

#### **2.1.4 Why the Hard Problem of Phenomenal Consciousness Runs So Deep**

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In this paper I challenge a popular way of characterizing the distinction between conscious experience and conscious thought. Specifically, I am concerned with the distinction between phenomenal consciousness and access consciousness (Block 1995, Chalmers 1997). A state is phenomenally conscious in virtue of its qualitative, subjective aspects (e.g., sensory experiences and perceptual states generally are clearly phenomenally conscious). A state is access conscious in virtue of its role in the rational control of behaviour (e.g., thoughts involved in the deliberation of courses of action are access conscious).

While it is widely agreed that cognitive explanations of phenomenal consciousness are particularly problematic, access consciousness, it is argued by the proponents of this distinction, is completely amenable to cognitive (functional) explanation. For instance, David Chalmers has argued that explaining access conscious mental events constitutes solving some of the "easy problems" of philosophy of mind and cognitive psychology; explaining phenomenal consciousness, on the other hand, constitutes

the "hard problem" (Chalmers 1993). Nevertheless, Chalmers contends that phenomenal consciousness is an organizational invariant; that is, it is a property or set of properties which supervenes on functional organization regardless of the physical substrate which realizes that functional organization. So while phenomenal consciousness may not be completely amenable to cognitive explanation, Chalmers argues, it does supervene on those mental states which are.

To support this position, Chalmers introduces a thought experiment involving the replacement of neurons with functionally isomorphic silicon chips. I will argue that this thought experiment is question begging. However, I contend that properly understood, it suggests interesting implications for a correct understanding of the relationship between conscious experience and conscious thought. Indeed, I agree that there is a distinction to be made between the two, but argue that phenomenal consciousness is essential to both. For this reason, I contend that the so-called hard problem of the mind-body problems runs much deeper than many suppose.

## 2.2 Conscious and Unconscious Perceptual Processes (Chair: Patrick Wilken)

### 2.2.1 Can Visual Masking be Used to Simulate Blindsight?: Confounds and Possibilities.

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"Blindsight" patients with lesions in primary visual cortex can retain above-chance ability to point to the location of visual stimuli that they are subjectively unaware of. A few studies (e.g., Graves & Jones, 1992) have claimed to show a partially analogous phenomenon in normal subjects who are asked to verbally guess the location of visual targets which are nonconsciously presented using the technique of backward-masking. Although this phenomenon appears to provide an opportunity to facilitate research on the cognitive and neural basis of blindsight, previous studies can be criticised methodologically. Most importantly, consciousness of target location was inadequately measured, and localisation may have been consciously mediated. A series of new experiments are reported, again comparing forced-choice (key-press) localisation and detection of masked targets. Localisation was indeed significantly more accurate than detection, but this advantage was shown to be consciously mediated, using a method which exploits the qualitative differences between conscious and nonconscious processing. Specifically, when subjects were instructed to report location by indicating the screen position opposite to that of the target, a similar advantage of localisation was observed; this instruction to reverse stimulus-response mapping is unlikely to have been complied with if location judgements were nonconsciously mediated. It therefore counterintuitively appears that

subjects can be conscious of target location, even if unable to consciously detect target presence. These findings place further caution on reliance on detection as an exhaustive measure of conscious stimulus awareness. The relation of findings to predictions of Signal Detection Theory are discussed.

### 2.2.2 How a Conscious Percept can Inherit a Property of an Invisible Prime

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We present a powerful new illusion (Fig.1) in which we flash two vertical lines on an oscilloscope screen, one below the other. The lower line is offset to the left or to the right. Following brief (i.e. 10-100ms) presentation of this vernier stimulus, a test grating comprising two rows of five perfectly aligned vertical bars, is displayed for 300ms. For short enough presentation times, all 20 subjects fail to perceive the prime, yet consciously perceive the double-bars to be offset in the direction of the prime (although they are not).

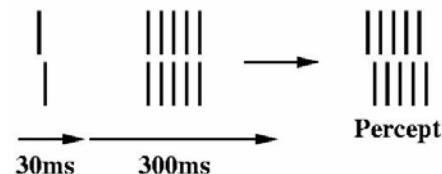


Fig. 1

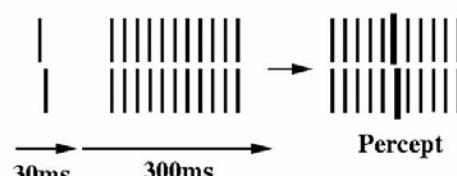


Fig. 2

The prime stimulus can be rendered visible when more bars are added to both sides of the grating (Fig. 2). This change of conscious percepts also yields a reduction of visual sensitivity; that is, the discrimination threshold for the direction of offset of the visible vernier when 20sets of bars are used in the mask is twice as good compared to the threshold for the invisible vernier when the mask is composed of but 5sets of bars. Thresholds is lowest for the vernier with no mask.

We conclude that the bars comprising the mask can inherit a property of the invisible prime. This effect can be eliminated by manipulating the extent and the spatial layout of the bars. We discuss the implications of our results for neuronal theories of masking and consciousness.

### **2.2.3 Subliminal Priming and Persuasion**

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Two studies were conducted to test a new model of persuasion called, 'tag-team' persuasion. This model which postulates that a persuasive communication will be more effective if prior to receiving the message, a person has been placed in a psychological state which makes him/her more receptive to the message. In the first study, we used subliminal priming techniques to create the state of thirst in participants. It was found that thirsty participants who were subliminally primed with thirst-related words drank significantly more of a beverage than participants primed with neutral words. This pattern of results was not obtained for non-thirsty participants (participants in both priming conditions drank equal amounts of the beverage). In the second study, we found support for the persuasion phase of the model. Participants who were subliminally primed with thirst-related words preferred a sports beverage which quenches thirst over a electrolyte-replacing sports beverage, whereas participants who were subliminally primed with neutral words showed no such preference. Implications for persuasion research are discussed.

### **2.2.4 Intentional Movements and Tactile Awareness**

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Neuropsychological disorders of consciousness and the self have provided valuable empirical data for the scientific study of consciousness, often forcing revision of intuitive notions of self. In neglect and extinction following brain damage, patients may be unaware of stimuli presented in contralateral space. Extinction, specifically, is a syndrome where the patient is aware of a contralateral stimulus presented in isolation but is unaware of this same stimulus presented with an ipsilesional stimulus. Most work in extinction has focused on passive experience of sensory stimuli. Here, we test the hypothesis that action can influence awareness of sensory stimuli on one's body. We studied two patients (EH and DC) with tactile extinction following strokes to the inferior parietal lobe (Brodmann's Area (BA) 40) and the posterior superior temporal gyrus (BA 22). Both patients were significantly more aware of a contralateral stimulus when moving intentionally on the stimulus than when the stimulus was moved on them ( $X_2(1) = 6.37$ ,  $p = 0.012$  for EH and  $x_2(1) = 12.25$ ,  $p < .0001$  for DC). EH was 7.9 times and DC was 36 times more likely to be aware of stimuli on the left with intentional movement than when receiving the same stimuli passively. Our study shows for the first time that tactile awareness is enhanced by intentional movements. Intentional movements may play a previously unappreciated role in an important aspect of consciousness, the consciousness of sensory stimuli on the self.

## **2.3 Self and Action**

(Chair: Ian Whishaw)

### **2.3.1 Recognising One's Own Actions: The Neural Correlates Of Self-Monitoring**

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Using functional neuroimaging we have investigated how the brain distinguishes between self produced sensations and those that are externally produced. We have previously shown that self-produced movements attenuate tactile sensation<sup>1</sup>, and using fMRI, that self-produced tactile sensations are "gated" in somatosensory cortex and the anterior cingulate cortex, a process that involves the cerebellum.

To test the hypothesis that the cerebellum is involved in predicting the specific sensory consequences of movements, we used H2O15 PET to examine cerebellar responses to self produced tactile stimuli in which we parametrically varied the delay between the subject's movement and its tactile consequences. 6 subjects underwent 12 PET scans. Subjects used their right hand to move a lightweight rod attached to an encoder sinusoidally. The motion of this rod determined the position of a motor, on which was mounted a piece of soft foam which made contact with the subject's stationary left hand. The motion of the rod held in the right hand was faithfully transmitted to the piece of foam thereby ensuring that the motion of the right hand determined the tactile sensation on the left hand. By delaying the transmission between the encoder and motor, computer controlled delays of 0, 100, 200 and 300 ms were introduced between the action of the right hand and the tactile sensation on the left. Subjects reported a progressive increase in the "intense" and "tickly" rating as the delay was increased from 0 to 300 ms, and activity in the cerebellum correlated with the delay. These results suggest that the cerebellum is involved in predicting the specific sensory consequences of movements, and providing the signal that is used to attenuate the somatosensory response to self-generated stimulation. This neural system is likely to be involved in recognising one's own actions.

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2. Blakemore, S-J, Wolpert, DM & Frith, CD. "Central cancellation of self-produced tickle sensation." Nature Neuroscience 1(7), 635 – 640 (1998).

### **2.3.2 Recognition Of Self-Generated Actions**

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One fundamental aspect of self-recognition is the ability to distinguish between those changes in sensory input that are the consequence of self-generated actions and those

changes that are the consequence of other-generated actions.

We hypothesize that the spatial and temporal characteristics (i.e. the kinematics) inherent in action effects can provide cues to guide self-recognition. The rationale behind this hypothesis is that those cues may reflect the contents of representations involved in action planning. Perceiving the effects of an action may activate the same codes that guided the execution of the movements to obtain those effects. If this is true self-recognition may be achieved by matching codes normally used in action planning against perceived action effects. Moreover, the same mechanism may allow one to anticipate forthcoming effects of self-generated actions more accurately.

Three lines of experiments provide evidence for our hypotheses: (a) When watching moving dot displays reproducing the kinematics of self- and other-generated drawing, individuals are able to recognize which trajectory was produced by themselves and which by others; (b) when watching moving dot displays which reproduce parts of a drawing trajectory, individuals can anticipate what will follow for self-generated but not for other-generated trajectories; c) when watching a video of a person throwing darts individuals can anticipate more accurately where on the target board a dart will land when watching self-generated movements.

### 2.3.3 Prefrontal Cortex And Monitoring Of Actions

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Control of action is required at different levels of the executive process, and notably for sensori-motor integration and conscious monitoring. The aim of this study was to determine at which level of the control of action the frontal lobes are involved.

For that purpose, we compared the performance of 15 patients with frontal lobe lesions and 15 matched controls on an experimental paradigm generating a conflict between the action executed and its visual feedback. Subjects had to trace a sagittal line with a stylus on a graphic table. The hand was hidden by a mirror on which the traced line, processed by a computer, was projected. Without informing the subjects, a bias to the right was introduced and increased progressively from 2 to 42°. To succeed the task, subjects had therefore to deviate their hand in the opposite direction. Sensori-motor adjustment was evaluated by the surface between the traced line and the ideal trace needed to correct the bias. Conscious monitoring was measured as the angle of the bias for which subjects became aware of a conflict.

The deviation was similarly compensated for by patients and controls until 24°. Then 14 controls but only 3 patients were aware of a deviation. After that, the variability of performance increased significantly for the unaware patients. Nine patients never became aware of a conflict between the action executed and its visual feedback.

These results suggest that frontal lobe is required only at the level of conscious monitoring of actions.

### 2.3.4 The Action Test

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Descartes' "action" test of conscious beings is the test of failure; that is, when they fail, he states, machines (and "animals"), unlike humans, reveal that they are not acting through understanding. Superficial comparisons of human and animal actions, in which subjects are compared on skills such as running ability or memory for hidden objects, encounter the "damned if you do and damned if your don't" obstacle. For every human skill, there is an animal with a surpassing skill. Experimental studies generally do no better in coping with the action problem. More than seventy years of comparative studies on laboratory rats and humans, in which the primary measure of behavior has been success or failure (i.e., number of errors), has given little insight into comparative consciousness. This presentation will describe a "level playing field" approach. The behavior of foraging rats is examined when their food source, their home, and surrounding cues are changed in various ways. Evidence will be presented to show that the animals concurrently make two records of their behavior, one based on external (allothetic) cues and one based on self-movement (idiothetic) cues. When strategies based upon one record fail, animals switch to strategies based upon the second record. The studies and an examination of the neural structures underlying this dual recording/execution ability argue that rats pass the action test in a way very similar to humans, thus arguing for continuity in consciousness.

## 2.4 Cognitive Models of Consciousness (Chair: Douglas Watt)

### 2.4.1 Consciousness, Executive Function And The Self In An Approximate Model Of Cognition.

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Barnard's Interacting Cognitive Subsystems framework (ICS, Barnard 1985) is a distributed, modular model of cognitive function that does not contain any central executive process. It has no single Cartesian Theatre. With nine independent cognitive subsystems, each processing a qualitatively different form of mental representation, it allows cognition to be described as the flow of information between different subsystems, and hence between different representational forms. The subsystems have a common internal architecture and mode of operation, but are distinguished by the information that they receive and transform. Sensory subsystems process acoustic, visual and bodily information; effector subsystems control articulatory and motor action; central subsystems deal with object-structures, sound-structures, propositional-meaning and implicational-meaning. This last level represents the world

through high level schemata, especially those relating to 'the self'. Diffuse and focal awareness is intrinsically linked to the flow of information between representational forms, which suggests that there are multiple 'levels of consciousness'. The action of the overall cognitive system is constrained by requirements for processing and access to memory at each level, and by reciprocal exchanges between different levels, not by a central executive or attentional allocation system. There may be a Cartesian Multiplex, but no-one is watching.

#### **2.4.2 Locating the Self in a Multi-Track Model of Consciousness**

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In a recent paper we defend a connectionist theory according to which conscious experience is identical to the vehicles of explicit representation in the brain (see "A connectionist theory of phenomenal experience" *Behavioral and Brain Sciences* 22 (1999)). This theory suggests that human consciousness is manifold and distributed. It is manifold because our instantaneous experience is a very complex aggregate state composed of a large number of distinct and separable phenomenal elements. And it is distributed because there are multiple sites of consciousness-making scattered throughout the brain. We refer to this as a *multi-track* model of consciousness, by analogy with the recording technology that enables music to be distributed across numerous physically distinct tracks of a tape. A multi-track model treats conscious experience as an amalgam; a collection of phenomenal elements, each generated by a distinct mechanism or process in the brain. A *single-track* model, by contrast, assumes that conscious experience is the product of an executive: a single (central) process or mechanism that binds all the various contents of consciousness together.

Multi-track models are increasingly popular in cognitive science, largely because the neuroscientific evidence militates against a privileged locus of consciousness-making in the brain. But when it comes to locating the subject of experience (the self) in the activity of the brain, multi-track models appear to suffer from a serious problem. If consciousness is not a stream but a mass of tributaries running in parallel, what is it that binds the various phenomenal elements together to form a single subject? In this paper we address this problem by canvassing a couple of suggestions as to how the collective and cooperative activity of many networks in the brain could construct a self to whom all of these experiences belong.

#### **2.4.3 Feelings In The Fringe: How Non-Feature Awareness Functions In The Global Workspace, Or Why Self-Monitoring Results In Feelings In Consciousness.**

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An increasing number of psychological writers have acknowledged a role for what William James called the fringe of consciousness (Mangan, 1991; Galin, 1992; McGovern, 1993). The fringe or "non-feature awareness" as Galin (1994) calls it can be seen as playing a unique information-bearing role in the architecture of consciousness. It is argued that non-feature awareness, or what we ordinarily call "feelings," is known by its own class of qualia (sad, familiar, right, meaningful) distinct from the qualia found in conscious perceptual contents (red, loud, salty). And further, while conscious perceptual qualia inform us about the current status of the environment in which we live and act, feelings or non-feature awareness inform us about the state of the self or the state of the self with respect to the environment. In James Gibson's (1966) terms both perceptual and feeling consciousness are proprioceptive, i.e. sensing the self. They have different referents -- environmental vs. intrapsychic. The unique characteristic of feelings is that they are attributed to environmental objects; the resulting coherence of feeling and an environmental object circumvents the capacity limits of consciousness, the hallmark feature of consciousness as described by Global Workspace theory (Baars, 1988, 1998).

#### **2.4.4 Emotion and the Extended Reticular Thalamic Activating System (ERTAS): Global Workspace and the Neglected Contributions of Midbrain**

##### **Periaqueductal Gray**

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In the burgeoning literature about the neural basis of consciousness, affect is generally relegated to the back of the bus as an interesting "coloration" to the "hard problem" of consciousness. Most current theories of consciousness neglect evidence that emotion is a central organizing process for consciousness, probably one of its necessary and sufficient conditions. There are deep and intrinsic interpenetrations of global state functions that we have largely segregated, such as pain, affect, attentional functions and executive functions (as "slices" of the consciousness pie). Without central representation of value, available "on-line," executive and attentional functions are collapsed at their base. Paralleling their extensive functional interpenetration, global state functions have vast overlap in putative neural substrates. Regarding neural correlates for emotion broadly defined, the "limbic system" at this point is so widely distributed that it has very unclear limits, derivative of the failure to clearly distinguish between emotion as a prototype or "primitive" vs. the much broader problems of emotional meaning, conditioning, and learning, as these relate to the global representation of value which is interpenetrant with much of CNS activity. Even defining emotion in terms of its "primitives" or prototype affects yields differential but highly distributed-hierarchical neural substrates. Affect is elusively multi-dimensional, with patterned autonomic, endocrine, motor-executive, subjective pain/pleasure (valence), social/signaling, and cognitive (other/self appraisal) integrations. Emotional

"primitives" are organized largely in diencephalic and midbrain structures ignored in most work on emotion where most focus on telencephalic structures that support "valence tagging" but that cannot underwrite valence itself. Basic connectivities between affective systems and the core systems of ERTAS underline the likely importance of these same primitive midbrain systems for consciousness: 1) connectivities between the midbrain reticular formation (MRF) and periaqueductal gray (PAG); 2) connections of thalamic ILN to midbrain PAG, various limbic, and BG systems; 3) predominant limbic modulation of thalamic nRt "gatelets" by nucleus accumbens, paralimbic cortices, BG, and DM thalamus-prefrontal regions. Severe damage to PAG (a clearinghouse in the diencephalon-midbrain for primitive value operators with crucial projections to monoamine nuclei, ILN and MRF), profoundly impairs consciousness. PAG interactions with other ventral systems in SC and deep tegmental regions may form substrates for a primitive and basic neural representation of the self. Such a primitive self-representation may form a hidden backdrop for consciousness and a resting neural "center of gravity." But there can be only modest specificity at this point about the fundamental relations of emotion and consciousness, and many basic questions remain. At the end, these are reviewed, along with suggestions for future research to outline PAG's role and the role of "valence" or primary emotion in consciousness.

## **CONCURRENT SESSIONS 3**

### **3.1 Meaning, Language, and Consciousness**

(Chair: Jillian McIntosh)

#### **3.1.1 Language and Conscious Experience.**

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In earlier work, I argued that the conscious experience of familiarity of appearance, e.g. something's looking familiar or sounding familiar, is a distinctive perceptual experience, rather than, as philosophers and psychologists often suggest, a *sui generis* 'feeling', occurring subsequent to perception. I argued that the experience is characterized by one's having a relatively detailed perceptual impression of a stimulus in less time and with less effort than would be necessary were the object unfamiliar. A successful prediction of my hypothesis is that we will not have this experience of perceptual familiarity with relatively simple stimuli, such as pure colors and tones.

In this paper, I consider a series of experiments on recognition-memory for colors, often thought to confirm the Sapir-Whorf hypothesis. Psychologists have found a correlation between ease of verbal classification of a color within a linguistic community and accuracy of its recognition. But, the hypothesis of perceptual familiarity

explains this correlation. In color memory, recognition is highly dependent on verbal encoding because subjects cannot use perceptual ease to determine familiarity.

I examine two mistakes often made in philosophical discussions of the Sapir-Whorf hypothesis. One error is thinking that language directly influences conscious perceptual experience, when it is the perceptual experience that accompanied language-learning that affects later conscious experience. Another is thinking that language directly influences non-linguistic perceptual experience, when what it influences is a linguistic phenomenon itself. The color memory tradition in psychological research on the Sapir-Whorf hypothesis is an example of the second error.

#### **3.1.2 Consciousness, Self, and Meaning.**

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The notions of consciousness and self bear significantly on the problem(s) of meaning, external reference, and intentionality. We will address this by examining connections between various issues concerning indexicals, identities, Twin-Earth arguments, and self-reference. The upshot will be an argument for the view that meaning is a property of conscious systems alone, in close correspondence with much earlier ideas of Brentano.

In one of the most celebrated papers of twentieth-century philosophy, Hilary Putnam argues that "meanings just ain't in the head." I will argue that Putnam's argument -- the so-called Twin-Earth argument -- as well as related arguments by Burge, have a fatal gap, connected to the notion of self, and that a proper rectification ties together the notions of meaning and mind in a manner in which the notion of self is crucial.

One key idea is that molecule-for-molecule identical brains are type-identical but not token-identical; this is recognized by Putnam but a consequence of it is not explored: the self of one brain is not the (very) same self of another even if they are type-identical. On closer examination, it appears that meaning can indeed be in the head, when we understand that notion to be dependent on the (token) self in each head. This also bears on the question as to whether two individuals' conscious experiences can be compared.

A second key idea that plays into the above, is that consciousness without self-consciousness may be an impossibility, and that experience (and meaning) require a self in order to provide the requisite indexicality that is the real import of Twin-Earth arguments properly understood.

#### **3.1.3 Why the Self Needs Language.**

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In what ways does language structure contribute to the

uniqueness of self's implementation? This seems to be the case along the following lines, among others:

- (a) Through the possibility of dissociating an explicit (representational) self and the executive (implicit) self, e.g., as in *I see a banana on the table*, vs. *There is a banana on the table*;
- (b) Through the possibility of dissociating the explicit self from perspective in representing the semantic content of a clause as 'mental object', e.g., as in *I will go to London tomorrow* vs. *I will come to London tomorrow*;
- (c) Through the possibility of establishing long distance, e.g., anaphoric and pronominal, relationships between different instantiations of the explicit and/or the implicit self in on-line discourse development.

An example for the role of both (b) and (c) is provided by Chomsky (1993:24-25) in treating the problem of the 'silent subject':

- (1) *Jones was too angry to run the meeting.*
- (1') "Jones wouldn't run the meeting because of his anger"
- (1'') "We couldn't run the meeting because of Jones's anger"

There are two possibilities to interpret (1) — either as (1') or as (1''). In the latter case, in interpreting (1) we insert the 'silent', i.e., not given explicitly, subject *we*. In this way, language provides us with means to 'hide' the self which seem not to be available in using other representational media in the mind.

## 3.2 Visual Consciousness

(Chair: Jody Culham)

### 3.2.1. Consciousness and Ultra-Rapid Serial Visual Presentation.

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How do we become aware of what we see? To study this question, we presented macaques and humans with sets of unrelated natural images displayed as a continuous stream, at rates faster than previously studied (up to 72 images/s). In the monkeys, we recorded cells in high-level visual cortex responding to complex patterns (e.g. faces). At the fastest rate, ~60% of neurons still responded most to the same stimulus they responded to at the slow rates, indicating that neural processing of the stimulus is preserved. We tested human ability to detect and memorize individual images under similar conditions: we displayed a target image either before (detection) or after (memory) a rapid sequence of images and asked the subjects whether the target was part of the sequence. Detection performance decreased with increasing presentation rate yet always remained above chance. Memory performance was much lower at all rates, and at chance level for the fastest rates

where subjects reported a loss of vivid visual awareness of individual images. Therefore, at the fastest rates, we observed a dissociation between (a) neural firing and detection and (b) awareness and memory. While response duration, amplitude and mutual information correlated with visual performance indicating possible 'neural correlates of consciousness', neural firing in the late visual areas per se is insufficient for visual consciousness. By the time neurons in the highest visual areas responded (108ms latency), 7 stimuli have entered the visual system [108ms/(14ms/image)]. This simultaneous stimulus representation might prevent the emergence of a crisp awareness.

### 3.2.2 On the Explicit and Implicit in Visual Awareness.

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Currently, there are two streams of opinion on the neural correlates of visual awareness. One stream puts forward the view that visual awareness correlates with the "explicit" representation of visual features in the higher visual areas. Crick and Koch (1995) put forward the view that only neural activities in those visual areas directly connected with the prefrontal and parietal cortices correlate with visual awareness, excluding the primary visual cortex (V1). On the other hand, the neurology of blindsight implicates that the loss of V1 results in a loss of visual awareness, indicating a central role of V1 in visual awareness.

I argue that the Crick and Koch hypothesis and the V1 hypothesis can be made compatible by noting that explicit representation of visual features in higher visual areas do not necessarily result in visual qualia. The completion of illusory contours are often done amodally. The explicit representation that Crick and Koch equate with visual awareness does not necessarily invoke visual qualia corresponding to that representation. On the other hand, the neural activities in early visual areas seem to be essential in invoking visual qualia. I construct a model of visual awareness in which the activity in V1 is essential in invoking visual qualia, while activities in higher visual areas give explicit representation of visual features but do not necessarily result in qualia. This model gives new insights into the common mechanism underlying binocular rivalry and amodal completion.

### 3.2.3 Conscious Decisions Can Be Based on Unconscious Coding.

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Humans possess two independent representations of visual space. One, a cognitive or "what" system, processes image information for pattern recognition and visual experience. Its contents are conscious -- accessible to long-term

episodic memory, decision processes, and visual context. The other system, a sensorimotor or "how" system, controls visually guided behavior. Its memory is only long enough to execute an act, but it possesses an egocentrically calibrated metric of space that the cognitive system lacks. Its contents are unconscious, and can conflict with the contents of the cognitive system. We separate the two systems with an illusion of static position, the Roelofs effect: an eccentrically located background biases perception of a target's location (cognitive). Open-loop pointing to the target (sensorimotor), however, is unaffected by the background. In some circumstances the two systems must communicate with one another. For example, motor activities are usually initiated when the cognitive system informs the sensorimotor system about what to do. But the object-centered code of the cognitive system should be incompatible with the egocentric spatial code of the sensorimotor system. Using the lack of a Roelofs effect as an indicator of sensorimotor-system information, we have found that making a decision about which of two targets to strike does not prevent subjects from using accurate sensorimotor information to guide their movements. The nervous system might link the codes by directing spatially specific visual attention on the object of action, using the eye movement control system to collapse visual space onto a single object.

### **3.3 Schizophrenia (Chair: Peter Williamson)**

#### **3.3.1 Personal Identity and Schizophrenia: A cognitive model of immunity to error through misidentification.**

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The concept of immunity to error through misidentification relative to the first-person pronoun (the "immunity principle"), is central to certain accounts of personal identity (Shoemaker). This paper proposes a cognitive explanation of the immunity principle based on Frith's analysis of inserted thoughts in schizophrenia. As a way to fix the precise meaning of the immunity principle and its limitations, I discuss neuropsychological experiments on reflexive access to phenomenal consciousness, and I contrast the results of such experiments with the experience of inserted thoughts.

The immunity principle is based on what Wittgenstein called the use of the first-person pronoun "as subject." He suggests that if a person says that she has a certain experience, it would be nonsensical to ask "are you sure that it's you that is having the experience?" This involves a surety of access to one's own experience. Recent experiments that show reflexive access to be dissociable across different modes of report (Marcel 1993) demonstrate that the immunity principle is different from the Cartesian claim about the surety of knowing one's own mind. The experiments undermine the Cartesian claim, but not the immunity principle.

The dissociations found in Marcel's experiments, however, contrast with the case of inserted thoughts in schizophrenia, and I show that the phenomenon of inserted thoughts does violate the immunity principle. If this is right, it provides a clue for working out a neuropsychological account of the immunity principle. Frith's cognitive model for what goes wrong in the case of the schizophrenic also provides an account of our normal immunity to error through misidentification.

Bibliography on Person, Self, and Personal Identity:  
<http://gort.canisius.edu/~gallaghr/pi.html>

#### **3.3.2 Delusions, first rank symptoms and agency: Psychopathological concepts, neurobiological correlates and philosophical consequences.**

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Schizophrenia is neither a homogenous entity nor a disease with a single etiology. Nonetheless, many papers discussing theories of the self refer to schizophrenia as if it were a single disease. When subsyndromes are taken into account delusions are treated together with hallucinations under the headings of "positive symptoms" and "reality distortion syndrome". In particular, Schneiderian first rank symptoms, i.e. passivity phenomena and delusions of alien control (in German psychiatry called: "Ichst rungen") are virtually neglected. However, delusions and "Ichst rungen" can be studied using cognitive neuroscience methods in order to investigate the physiology and pathophysiology of "agency". Agency is the experience that oneself is the originator of one's thoughts and actions. It is a key concept for theories of the self and of free will. Our paper sets out to answer the questions of what delusions are, how they relate to "Ichst rungen", what we know about their neural correlates in schizophrenia and related neurological disorders, and what consequences our (limited) knowledge may have for a neurophilosophical theory of agency.

#### **3.3.3 Disorders of the Self in Schizophrenia: Personal Identity and Episodic Memory.**

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INTRODUCTION: Schizophrenic patients can show identity disturbances such that they feel and experience themselves as another person, as for example as Jesus. Such identity disturbances raise neuroscientific as well as philosophical questions, for physiological brain mechanisms in the generation of the feeling of personal identity as well as for necessary and sufficient criteria, as for example, memory, of personal identity. Hence the purpose of the present abstract is to develop a neurophilosophical theory of personal identity in relation to memory in schizophrenia.

METHODS: Subjective experience i.e. phenomenology of identity disturbances in schizophrenic patients is investigated by means of semistructured interviews. An

activation design with retrieval of autobiographical memory versus heterobiographical memory with a "remember/know paradigm is developed and investigated behaviorally and electrophysiologically i.e. with EEG in healthy controls, schizophrenic patients with identity disturbances, and in schizophrenic patients without identity disturbances. Finally empirical results are discussed with regard to pathophysiological mechanisms of identity feeling as well as with regard to memory as a criterion for personal identity.

**RESULTS:** Subjective interviews reveal that schizophrenic patients are totally convinced that they are another person. They "feel" and subjectively experience that they are the other person, everything is re-interpreted in the light of the characteristics of the "new" person.

Preliminary behavioral results reveal that schizophrenic patients with identity disturbances show significantly less "remember" responses in relation to autobiographical events than schizophrenic patients without identity disturbances and healthy controls. Furthermore schizophrenic patients with identity disturbances show significantly decreased amplitudes of the early N100 and the P300 in right fronto-temporal electrodes during autobiographical memory but not during heterobiographical and semantic memory. With regard to criteria of personal identity results in schizophrenic patients demonstrate that, empirically, autobiographical memory may be considered at least a necessary criterion of personal identity since otherwise concomitant alterations in autobiographical memory and personal identity in schizophrenic patients could not be explained.

**CONCLUSION:** Schizophrenic patients with identity disturbances may show alterations in right frontal-temporal early information processing during retrieval of autobiographical memory. Consecutively the right fronto-temporal cortex as well as retrieval of autobiographical memory may play crucial roles in the generation of personal identity.

### **3.4 Pain and Consciousness**

(Chair: C. Richard Chapman)

#### **3.4.1 The Experience of Pain in Infants and Children.**

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The relationships among nociception, pain, and suffering in infants and children continue to be topics of intense discussion. Infants (from approximately 26 weeks gestation age) have the neural capacity to respond to tissue damage; at birth, they demonstrate a vigorous physiological response to pain-producing stimuli. As infants develop, their experience and response to pain seems to change in subtle ways that may reflect maturation of complex pain-suppressing systems. Their pain experiences and pain behaviors continue to change throughout childhood. The same level of tissue damage seems to produce progressively less pain as children mature. Clinical reports and research studies suggest that children's pain is more

plastic in comparison to adults, in that children have a greater ability to modulate their pain. This presentation provides a brief introduction to our understanding of the unique aspects of children's experience of pain.

#### **3.4.2 Two Issues Concerning Consciousness and Pain.**

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A standard definition of pain depends upon it being a function of conscious experience. It appears that the notion of awareness of experience or conscious experience is the primary basis for this definition of pain rather than neural signals from tissue damage. Clinical observation shows that the presumed fit between nociception and the experience of pain is often loose and sometimes absent. What does this tell us about the nature of consciousness? Can a definition of consciousness be provided to support the definition of pain? Second the biological function of pain seems self-evident, but chronic pain may be both self-sustaining and maladaptive. Consciousness appears to be more salient, or it is more acceptable to assume its occurrence, the more developed the organism is considered to be. We might infer that consciousness functions as all or part of a rapid scanning or analytic mechanism to evaluate sense data and internal processes. Why should consciousness entertain awareness of tissue trauma that is not new but is maladaptive and often inaccurate as a sensory indicator? Pain can reflect emotional states. This presentation will explore the complex causes of pain as conscious awareness.

#### **3.4.3 Suffering and Chronic Pain: The Role of the Self.**

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Persisting pain causes suffering, but how and why remains uncertain. Pain is perceived threat or damage to one's biological integrity. We propose that suffering is the perception of serious threat or damage to the self that emerges when a discrepancy develops between what one expects of one's self and what one does or is. Some persons who experience sustained, unrelieved pain suffer because pain imposes disability and thereby changes who they are. At a physiological level, chronic pain is a stressor that promotes an extended and destructive stress response marked by neuroendocrine dysregulation, fatigue, dysphoria, myalgia, and impaired mental and physical performance. This constellation of discomforts and functional limitations tends to generate negative thinking, and this in turn creates a vicious cycle of stress that sustains disability. The idea that one's pain is uncontrollable, for example, is itself a stressor. Persons suffer when pain renders them incapable of sustaining productive work, normal family life, and supportive social interactions. In other words, they cannot be themselves. Release from suffering can occur without relief of pain when the individual redefines the sense of self.

## **CONCURRENT SESSIONS 4**

### **4.1 Evolution and Epistemology of Consciousness**

(Chair: Jillian McIntosh)

#### **4.1.1 Can Science Know When You're Conscious? Verbal Reports and the Simulation Heuristic.**

Alvin Goldman

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There are two possible ways of interpreting verbal reports in scientific studies of consciousness. First, a verbal report might indicate the presence of a conscious state because it is one of the outputs included in a functional specification of consciousness (cf. Block 1995 on "access consciousness"). Second, a verbal report might support the presence of a conscious state because it expresses a trustworthy knowledge claim by a subject about a conscious state. Both alternatives are explored here. Even the most attractive functionalist proposals (e.g., Block's) are problematic because their three functional elements -- reportability, rational control of action, and usability in reasoning -- are questionable requirements or indicators of consciousness (cf. Milner and Goodale 1995; Schooler and Fiore 1997; Mangan 1993). The second approach is more promising, but seems to require converging evidence to validate subjects' competence at detecting their own awareness states (Cheesman and Merikle 1986). Not any old converging evidence, however, will help. It must not only warrant the claim that subjective reports indicate some valid construct, but specifically indicate consciousness, which requires a prior criterion of consciousness. This paper argues that psychologists assume the (qualified) validity of subjects' introspective reports because they presume themselves to have valid introspective competences and tacitly apply the "simulation heuristic" (Gordon 1986; Goldman 1989) to others. Baars (1997) illustrates scientific appeals to one's own introspective competence. The scientific legitimacy of this procedure is examined.

#### **4.1.2 The Epistemology of Qualia.**

Andrew Bailey

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I assert that qualia are real, internal, full-bloodedly phenomenal, and possibly physical and provide an examination of the epistemology of qualia, asking primarily whether and in what sense qualia are "given." I distinguish between the phenomenal apprehension of qualia—which is just what it is to have qualia—and propositional apprehension of qualia, which involves having beliefs about one's own qualia. I then analyse givenness into three components—immediacy, certainty and privacy—and discuss each in turn. I conclude that phenomenal apprehension of qualia is indeed in some sense

"immediate," that it is "certain" in the sense of being indubitable, evident and incorrigible, and that it is de facto highly "private." However, I try to show that, although qualia do turn out to be "given" after all, this adds nothing problematic either to the notion of qualia or to the prospect of physicalism: to be "given," it turns out, is not necessarily to be especially mysterious or incoherent. I agree that qualia are not "Given" in the very strong sense accepted by the logical positivists but rejected by Sellars and Wittgenstein, that of providing an absolutely certain epistemological foundation—a set of indisputable propositions about facts. Propositional knowledge of our own qualia, I show, can (rather simplistically) be said to be generally more "certain" than propositional knowledge of the "external world," but has no absolute certainty. Finally, though, I raise the prospect—ignored or rejected by Sellars and Wittgenstein—of phenomenal apprehension providing some kind of check upon our cognitive attitudes towards our own qualia.

#### **4.1.3 The Phenomenal Phenotype: Evolution and ontology.**

S.M. Miller

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It has been suggested that an organism's phenomenal consciousness is part of its phenotype (Miller, 1998; Dessalles & Zalla, 1998). The appearance of the world *to* an organism, the organism's experience or phenomenal consciousness, is activity in a neural subsystem of the organism. This activity may include phenomenal consciousness of the organism's body and its other neural subsystems, and in some species may manifest as the capacity to distinguish self from other. The *type* of appearance *to* an organism is contingent on the organism's neurophysiological organization and varies according to the organism's genotype and its developmental and environmental history. This variation occurs within and between species forming within-species and species-specific phenomenal phenotypes.

The all-or-nothing nature of the 'something-it-is-like' descriptor of phenomenal consciousness (Nagel, 1974) is consistent with the notion of a critical neural complexity distinguishing organisms with phenomenal phenotypes from their ancestors whose phenotypes did not include this phenomenal aspect. Irrespective of where in phylogeny this distinction is situated, it heralds the evolution of biological systems with the ontologically unique phenotypic feature of a subjective perspective. The existence of this perspective is consistent with monism. To deal with phenomenal consciousness however, a monist account must acknowledge what is unique about neural systems with subjectivity - (i) the experience of being a subjective system is left out of its complete physical description, (ii) direct intersubjective exchange is not possible, and (iii) the scientific study of these systems has limitations.

1. Miller, S.M. (1998) Biology and Consciousness: Further Extending the Phenotype. Neural Correlates of Consciousness: Empirical and Conceptual Questions, Meeting of the Association for the Scientific Study of Consciousness, Bremen.

2. Dessalles, J.L. & Zalla, T. (1998) Phenomenal Consciousness as Phenotype. Neural Correlates of Consciousness: Empirical and Conceptual Questions, Meeting of the Association for the Scientific Study of Consciousness, Bremen.
3. Nagel, T. (1974) What is it like to be a bat? *Philosophical Review*, 83: 435-450.

#### **4.1.4 Dretske's Representational Theory of the Mind on Qualia and Self-Knowledge.**

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In *Naturalizing the Mind*, Fred Dretske presents a naturalistic theory of the mind the most basic tenet of which is that all mental facts are representational facts. This theory deals, among other issues, with the phenomenal qualities (or qualia) of mental experience and introspective self-knowledge in representational terms. My aim in this essay is to bring forth some difficulties with both the accounts of the phenomenal qualities of mental experience and introspective self-knowledge that this theory generates. I will begin with a brief summary of Dretske's analysis of what is involved in representation, in terms of which both the accounts of qualia and introspective self-knowledge are formulated. The former account will be very briefly described next, at the beginning of section 2. In the same section, I will present what I propose to be a difficulty with that account that concerns the relevance of the sensory modality in which a certain sensory experience occurs for the individuation of the qualitative properties of that experience. In section 3, I will discuss a second difficulty with Dretske's account of qualia, in that it does not seem to allow for some cases of inverted. Dretske's account of introspective self-knowledge as an instance of displaced perception will be discussed next. I will argue, essentially along the lines of an objection anticipated by Dretske, that such an account makes introspective self-knowledge inferential, which does not seem to respect the intuitive epistemic first-person/third-person asymmetry concerning our cognitive access to the content of mental states.

Dretske, F. *Naturalizing the Mind*. MIT Press, (1995).

## **4.2 Contents of Visual Consciousness**

(Chair: Jody Culham)

#### **4.2.1 Attention Modulation of Interference Effects are not Dependent Upon Conscious Awareness of Distracting Stimuli: Evidence from striate, parietal and cingulate lesions.**

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A major issue still facing cognitive neuroscientists concerns the nature of selective mechanisms of attention and the ability of individuals to inhibit or ignore irrelevant information. Previously, we have explored the ability of

subjects to use goal directed mechanisms to select visual information in the flanker task. In a series of single case studies the performance of patients with discrete cerebral lesions on the flanker was explored to further investigate the constraints of goal directed selective attention. Results demonstrated that normal interference affects can be observed even when distractor stimuli are placed in the blind or neglected visual fields of patients with striate or parietal lesions respectively. Importantly, we demonstrate that the patient with neglect is also able to modify the interference effect in a goal driven manner suggesting top down control of neglected information. Finally, we present evidence from a patient with a lesion of the right anterior cingulate cortex who is unable to demonstrate top down modulation of interference effects. These results are discussed in terms of the neural networks necessary for goal directed attentional control and the implications this model has for conscious experience.

#### **4.2.2 The Importance of Unattended Information for Change Detection.**

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If a visual display and a changed version of the same display are alternated back-and-forth on a computer screen, with a blank screen between the two displays, observers exhibit a striking failure to detect the change. This "change blindness" has been taken to show that people are only aware of information in the focus of attention, and that information outside of the focus of attention is overwritten by the most recent display (Rensink, O'Regan & Clark, 1997). The *overwriting hypothesis* – the view that information outside of the focus of attention is overwritten by new stimuli – has also been advanced on the basis of visual search experiments (Horowitz & Wolfe, 1994). Using a memory contingent search method, which combines the change blindness method with visual search logic, we found results that are inconsistent with the overwriting hypothesis. Our experiments show that unattended information is not overwritten but rather remains in memory across successive presentations of the displays. Furthermore, we suggest that memory for information outside of the focus of attention (i.e., in the fringe of consciousness) serves the important and functional role of determining what will be brought into the focus of attention.

1. Horowitz, T. S., & Wolfe, J. M. (1988). Visual search has no memory. *Nature*, 334(6), 575-577.
2. Rensink, R. A., O'Regan, J. K., & Clark, J. J. (1997). To see or not to see: The need for attention to perceive changes in scenes. *Psychological Science*, 8(5), 368-373.

#### **4.2.3 On the Structure of Visual Qualia.**

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Can we perceive true images? Although the weight of

current opinion holds that the perception of “images in the mind” is an illusion, that at a given instant we see considerably less than we think we do, and that what we do see does not have an image structure, it is argued here that the structure of phenomenal images of two-dimensional patterns observed on flat surfaces is similar to the structure of true images. Images are shown to be abstract in nature, to have a metric, a quantized geometry, and polydimensional chromatic values. Visual qualia arising from the observation of patterns on flat physical surfaces appear to have most of the structural attributes of true images, including a natural quantization defined by visual acuity, tridimensional chromatic values, and a form of metric. This conclusion is supported by results of experiments in which subjects reported their observations following 95 ms exposures to “pseudo-quantized random images”, a time period brief enough to preclude saccades or conscious attentional wandering. These experiments suggest that a great deal of geometrical information consistent with image structure may be contained instantaneously in a phenomenal visual episode. It thus appears that the categorical assertion that we cannot see true images is unjustifiable, although it is recognized that the structure of visual experience is more complicated in the more general case involving interaction vision and stereoptic viewing of scenes in depth.

#### **4.2.4 Anisochronic processing: are Dennett and Zeki in synchrony?**

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The Cartesian theatre model is characterized by Dennett (1991) as depicting events in the same strict chronological sequence as they occur in external reality. (I will call this "isochronism", by analogy with isomorphism.) Dennett's multiple drafts model in contrast allows for the asynchronous processing of sensory input, with no need to coordinate across time the various processes of stimulus analysis. In support Dennett cites some old experiments which claim to obtain non-isochronous percepts, such as the spot of light that appears to change colour mid-way along its trajectory in a phi motion paradigm (Kolers and von Grünau, 1976).

I will review: (a) some old experiments which demonstrate that processing delays are not compensated for in the way one would expect if isochronic processing were the norm, and (b) a spate of recent experiments suggesting similar asynchronies and anticipations in the processing of the various features or dimensions of visual stimuli. Some of the latter have been interpreted to indicate independent generation of many micro-consciousnesses in separate areas of visual cortex (Zeki, 1998).

I will also present some new experimental results revealing the lack of perceived simultaneity of changes in colour, motion and brightness, which confirm and extend those recently reported by Zeki and colleagues. Thus binding

does not always occur.

However, it is not straightforward to link all these empirical results with Dennett's model, which posits that asynchronous neural processing will not necessarily be reflected by asynchronies of consciousness. Alternative interpretations based on theories of specific time-processing modules will be discussed.

### **4.3 Self and Agency** (Chair: David Galin)

#### **4.3.1 Extending self-consciousness into the future.**

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Empirical evidence shows that the 2-year-old child already exhibits a degree of self-consciousness. But this self-consciousness involves only the here and now. It is not until children are past 3- and closer to 4-years-old that they begin to show evidence of a self-consciousness that extends through time. Most of the research which indicates this shift in self-consciousness has focused on the child's ability to remember her own past mental states, or to recognize herself in video-tapes taken earlier, in a way that indicates an understanding of how her past self relates to her present self. The research that I will report shows the same transition in self-consciousness to occur with respect to the future self for children between 3- and 4-years-old. In the primary task, children were asked to make choices between receiving smaller rewards in the present or larger rewards in the future. Sometimes these rewards involved the self, alone, and at other times they involved both self and another person. In several experiments 3-year-olds tended to choose the smaller present rewards over the larger future rewards, while the older children made the reverse choice. This occurred both for the self-alone and for the self and other condition. In several experiments these basic findings were correlated with children's performance on 'theory-of-mind' tasks and an 'executive function' task. The results of these experiments indicate that these several tasks are interrelated in a fashion, which suggests that future-oriented self-consciousness develops in several stages during the fourth year of life.

#### **4.3.2 Cosecification and conscious agency: Instantiated goals and the specification of self.**

Richard A. Carlson

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The cosecification hypothesis (Carlson, 1997) suggests that consciousness is an informational property of mental states, such that an experiencing self and experienced objects are simultaneously specified by information available to perception or from memory. This hypothesis is

based on theoretical observations by Gibson (1979), as reflected in Neisser's (1988) discussion of the "ecological self." The resulting view of consciousness provides hypotheses about control by conscious intentions, suggesting that moment-by-moment, instantiated goals both specify an acting self and provide procedural frames to which the objects of action are assimilated. The analysis is applied here to several sets of laboratory data on the acquisition and control of skill in multiple-step mental routines, and to observations about changes with practice in the experience and control of skills. This analysis also provides a link between computational models of cognitive skill such as ACT-R (Anderson & Lebriere, 1998) and phenomena associated with the conscious experience of agency. Finally, considering the skilled self in action leads to hypotheses about parallel formal structures of the conscious mental states involved in symbolic and perceptual-motor awareness across a range of skill domains.

#### 4.3.3 Misinterpreting the Mirrored Self

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The Delusional Misidentification Syndromes include a variety of disorders in which a person believes that their own identity or the identity of others has changed in some way. This can include believing that a person is a double or impostor (Capgras syndrome), believing that strangers are in fact people you know in disguise (Fregoli syndrome) and believing that you are dead (Cotard's syndrome). Included in the Delusional Misidentification Syndromes is self misidentification, which can take several different forms. One type of self misidentification involves a loss of recognition of the self when looking at one's own reflection in a mirror. Patients with this type of condition are unable to recognise their own mirror image and behave as though the reflection were someone else, someone who happens to be similarly dressed and to behave similarly. Two cases of misidentification of the self in mirrors will be presented. The case presentations will include video footage, review of the neuropsychological profiles and brain imaging. These behavioural phenomena and test results will be discussed with regard to the patients' sense of self and in relation to current cognitive models of Delusional Misidentification Syndromes.

#### 4.3.4 The Concept "Self" in Buddhism and in Western Psychology.

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The concept of *self* is at the core of both Buddhist and western psychologies, pervading daily life and theoretical writings for millennia. Yet there is much confusion over exactly what *self* means, for ordinary folk and for the

academics and professionals who are supposed to be experts on it. Thus, *self* is a promising point of contact for dialogue between the two systems.

The Buddhist tradition of "no-self" (*anatta*) holds that Ordinary Man's erroneous view of self as persisting eternally without change, is based on inborn patterns, pre-theoretic and unreasoned. The erroneous view is therefore inevitable, even though it is the cause of suffering, and a new corrective experience of self is needed. Therefore, Buddhism takes a great interest in how a person experiences their self, ie., in the *self as experience* rather than just *self as concept*, because meditation and service are designed to lead to a new (correct) experience of self.

Contemporary Western psychology reveals some of the mechanisms by which this "natural" view of self and person operates, how it is rooted in basic cognitive processes, and how it functions in ordinary life. I will present two perspectives on this pretheoretic view. The first concerns the human tendency to seek and find or project a simplifying pattern in every complex field. This results in imposing arbitrary boundaries and autonomous existence on the parts of densely interconnected systems, the self included. The second concerns the recent recognition that metaphor plays an enormous role in abstract thought, and in particular in our thinking about self, subject, and person. I will argue that these underlying cognitive structures account in part for why this (ultimately erroneous) view of self and person is so strongly maintained.

### 4.4 Unconscious Processes (Chair: Axel Cleeremans)

#### 4.4.1 Subliminal Oddball P300 ERP Component.

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The P300 ERP component, as generated in an oddball paradigm, has been well-documented as a marker for conscious expectancies. This study provides evidence that a P300 ERP component is apparent and functional in a standard oddball paradigm when all stimuli presented are not consciously accessible. The words LEFT and RIGHT were presented in a frequent-rare ratio (80%-20%), counterbalanced between subjects, and ERPs were measured at nine scalp electrodes (Fz, Cz, Pz, F3, C3, P3, F4, C4, P4). All stimuli were presented at the objective threshold ( $d' = 0$ ), the most stringent measure of subliminality. A larger P300 component amplitude was apparent and significant for rare vs. frequent stimulus presentations across the electrode montage ( $F(1,27) = 5.65$ ,  $p < .013$ ). No significant effects were found for P300 component latency. Implications are discussed for: comparing conscious and unconscious information processing, unconscious learning, and the measurement of ERPs to subliminal stimuli.

#### **4.4.2 Dissociating conscious and unconscious influences in sequence learning.**

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Can we learn without awareness? Albeit this important and long-standing issue has been extensively addressed in the field of implicit learning, there is currently no agreement about the extent to which knowledge can be acquired and projected onto performance in an unconscious way. For instance, in the field of sequence learning, sequential knowledge acquisition has often been claimed to be either exclusively explicit or exclusively implicit. In this paper, we assume that these conclusions are based on the erroneous assumption that tasks used to study sequence learning are process-pure. This assumption could therefore lead to an overestimation of explicit or implicit influences. Moreover, some recent studies have indicated that both implicit and explicit knowledge could influence subjects' performance.

In this paper, we show how Jacoby's Process Dissociation Procedure can be adapted to obtain separate estimates of explicit and implicit knowledge acquisition in a sequence learning experiment. We show that providing subjects with increasing amounts of explicit knowledge about the material before the onset of the choice-reaction time task tends to gradually increase explicit influence but to leave implicit influence unchanged on a subsequent generation task.

Finally, we also explore what kind of cognitive model could produce such a dissociation. In a series of simulations, we show that a modified simple recurrent network (SRN, Elman 1990; Cleeremans, 1993) is able to capture our dissociation results even though it is based on a single processing pathway. The model therefore suggests that the observation of dissociations does not necessarily entail separate underlying knowledge bases or processing systems. The key assumption instantiated by the model is that the implicit/explicit distinction is related to the strength of activation of the network's response units. Based on the successes of the model in accounting for our data, we therefore propose that the implicit/explicit dimension is best seen as a continuum rather than as a dichotomy.

#### **4.4.3 The Strategic Unconscious: Some Problem-Solving and Game-Playing Evidence.**

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We investigate the issue of how intelligent or planful unconscious processes may be in problem-solving and game-playing situations. We review some problem-solving data showing that the unconscious does exhibit planful and/or intelligent behavior. In addition, we present new

data acquired from people playing two types of strategic games that gives evidence of the acquisition of strategic behavior without awareness. The highly detailed data tracks changes in player efficacy and the acquisition of specific sub-strategies for the games, as the participants acquire skill over five hours of play against an expert A-I opponent. We compare this detailed behavioral data with verbal protocol data to ascertain whether the participants' skill exceeds their level of verbalizable knowledge. We examine particular times during learning when play quality undergoes large improvements to see whether verbalizable knowledge exhibits similar changes. The major finding was that sizable and often quite rapid changes in quality of play preceded any mention of strategy even when participants were pushed to reveal strategic information. On the basis of these relatively fine-grained data, we conclude that participants are indeed capable of acquiring strategic knowledge about playing fairly complex intellectual games without much evidence of concomitant changes in verbalizable knowledge. In addition, we discovered a particular circumstance that allowed people to acquire verbalizable knowledge independent of and prior to the acquisition of skill.

#### **4.4.4 Disambiguating Conscious and Unconscious Influences: Theory and experimental methods.**

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A central problem in unconscious process research is disambiguating conscious and unconscious influences. Despite intensive scrutiny, serious disagreement remains over its proper solution. This paper discusses the history and current status of various approaches to distinguishing conscious from unconscious processes, especially with respect to experimental unconscious perception and implicit (i.e., unconscious) memory paradigms. Application of signal detection theory will show that there are two general approaches: 1) Null discriminative sensitivity (the "objective threshold"); and 2) Null phenomenal sensitivity (the "subjective threshold"). Characteristically, objective threshold approaches have trouble proving null discriminative sensitivity, while subjective threshold approaches have difficulty ruling out criterion artifacts. Current approaches reflect attempts to solve these problems--for example, Greenwald et al's (1995) regression approach; Jacoby's (1991) process dissociation paradigm; Merikle et al's (1995) exclusion approach; and Snodgrass et al's (1993) absolute inhibition approach. One objective of this paper is to show that all current methods are variations on the fundamental objective vs. subjective threshold dichotomy; another is to evaluate their success in dealing with the characteristic problems. Relatedly, subjective threshold approaches' reliance on demonstrating "qualitative differences" between conscious and unconscious effects will be addressed; this issue has broad implications for implicit memory paradigms as well, which also rely heavily on such differences to infer unconscious processes.

## **POSTER SESSION 1**

### **1. An Advantage for Self- vs. Object-Rotations Given Physically Impossible Position.**

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Our previous studies have shown that it is easier for observers to update scenes after they imagine themselves rotating to a new position than after they imagine the objects rotating. The present studies continued to find an advantage for self-rotation when either the actual or the imagined positions of the observer defied the physical law of gravity. Participants memorized the positions of objects in a four-object array. They were asked to imagine rotating around the array or to imagine the rotation of the array itself. Our previous self-rotation advantage was found for transverse rotations around the objects when they were placed on pedestals on the floor. The current studies held the same perpendicular relationship between the observer and the objects, but asked observers to imagine rotations that defied gravity. In Experiment 1, the observers physically stood facing the diamond-shaped array of objects posted on the wall, but imagined lying down and rotating around the array (as if they were walking on the wall). In Experiment 2, observers were physically lying down and asked to imagine rotating around the array posted on the wall. In Experiment 3, observers were physically lying down, but asked to imagine standing, rotating around objects on the floor. In each case, the imagined relationship between the observer and array was held constant, although the physical relationship differed. Although all of the rotation conditions were impossible in the physical world, self-rotation remained superior to object-rotation.

### **2. Updating Scenes After Imagined And Physical Self-Movement**

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In order to update the world from a different imagined perspective, the observer must dissociate her physical egocentric coordinate system from that which is projected in mental space. Several researchers have shown that alignment and misalignment of physical and projected coordinate systems affect updating differentially when updating is performed via a pointing response (e.g., Farrell & Robertson, 1998; Rieser, 1989). In the current experiment, we tested similar manipulations using a verbal updating response. Seated participants committed a configuration of six colors to memory and were then blindfolded and asked to update the configuration verbally from different imagined perspectives. In the imagined condition, participants imagined facing a given color and then updated another color from this new perspective. In

the aligned-movement condition, they were passively turned in their chairs to a given color before updating another color from this new perspective. In the misaligned-movement condition, they were given one color to imagine facing, but were turned to a different color, and were required to update from the initial color perspective. These manipulations assessed whether type of response task plays a role in updating ability.

### **3. Perceived Orientation Of The Self And The Visual Environment**

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The visual world appears to us within a stable frame of reference. However, though often tacitly assumed, a perceptually stable visual environment is not the only single reference to which orientation judgements are referred to. This study reports a dissociation between visually perceived orientation and the perception of body position with respect to gravity. When the participants (n=11) are able to actively control their own posture they rely, at least partly, on other spatial reference information as compared to the task when a visual indicator is adjusted so that it appears vertical. In complete darkness, when lying on their side in the subjective horizontal body position, a luminous line does not appear horizontal when in line with the z-axis. It is set further down by 27° on average and therefore perpendicular to the subjective visual vertical. This finding supports the idea that the judgement of the orientation of the self and the judgement of the orientation of a seen object is based on different references.

### **4. Are All Glimpses of a Scene Equal?**

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People often exhibit a striking failure to detect changes between two different views of a scene. Are there differences in people's ability to detect such changes when the two views of a scene are presented sequentially in the same spatial location versus presented simultaneously, side-by-side, with unlimited viewing time? Anecdotal and experimental data suggest that most people believe that change detection should be easier when the two views of a scene are presented side-by-side. Our meta-cognitive data suggest that people's intuitions are incorrect. In fact, detection of the appearance/disappearance of objects or color changes did not differ across the two types of presentation. However, contrary to popular belief, detection of changes involving translations of spatial relationships was easier when the two views of a scene were presented sequentially in the same spatial location than when the two views of a scene were presented

simultaneously side-by-side. An important difference between the two presentation methods – or glimpses of a scene – is that the retinotopic frame of reference remains constant when the two views of a scene are presented in the same spatial location, whereas a different retinotopic frame of reference is associated with each view of a scene presented side-by-side. The results suggest that retinotopic information outside the focus of attention guides attention to the locations of changing spatial relationships within scenes.

## **5. Learned Associations Between Size and Shape Affect Conscious Perception of Size But Not Grip Scaling**

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Goodale and Milner (1992) have argued that the control of visually guided movements is mediated by cortical mechanisms that are largely separate from those mechanisms mediating experiential visual perception. Thus, visuomotor programming should be refractory to manipulations designed to affect perceptions of object size. To examine whether or not a learned association between size and shape can influence the programming of visually guided grasping, subjects were trained with two sets of plastic objects in which there was a systematic relationship between size and shape (circle=large; hexagon=small; or vice versa). Two test objects midway in size between the two training sets - one a circle, the other hexagon - were used to measure the effect of the learned size-shape association on size perception and grip scaling. The test object matched in shape to the set of small objects was estimated to be significantly larger than the test object matched in shape to the set of large objects - a size-contrast effect. In contrast, there was no difference in preparatory grip scaling for subjects who simply picked up the two test probes. The absence of a size-contrast effect in grip scaling suggests that visuomotor control is refractory to the learned associations between size and shape that clearly influence experiential size perception, possibly because the size and shape information underlying experiential perception is quite different from that underlying the control of visuomotor programming.

## **6. The Computation of Size in Manual Prehension and Conscious Perceptual Estimation**

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We carried out an experiment designed to look at the frames of reference used by real-time and delayed grasping movements. Subjects were presented with two ‘virtual’ objects in a mirror display, in which the two objects appeared to be resting on a surface in front of the subjects. One of the objects was marked with a dot. Subjects were

required to reach out and pick up the marked object using their index finger and thumb. [A real object identical in size to this virtual object was placed under the mirror in the same place as the image of the object.] On each trial, the marked object was paired with an object that was either larger, smaller, or the same size. When subjects picked up the marked object immediately, it did not matter which object it was paired with: the grasp was scaled to the real size of the target object and was not affected by the presence of the other object. When subjects picked up the grasp after a 5-s delay, however, a significantly larger grip aperture was observed when the marked object was paired with a smaller object, than when the same marked object was paired with a larger object. A similar size-contrast effect was observed when subjects gave manual estimates of the size of the marked object (i.e., they told us how big the object looked to them). This perceptual effect was observed both when the estimates were given immediately and when they were given after a 5-s delay. These results suggest that normal (real-time) visuomotor control relies on real-world metrics whereas delayed grasping utilizes the same relative (allocentric) frame of reference used by conscious perception.

## **7. The Effects of Self-Directed Exploration on the Recognition of Novel 3D Objects**

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Our perception of real, 3D objects may be intimately related to our active, explorative and manipulative motor behaviour.. To examine whether or not self-directed manipulation of visual input influenced subsequent object recognition, we studied the recognition of objects after active exploration or passive viewing of virtual, novel 3D objects. During the familiarization session, participants studied computer rendered, 3D objects in two ways: Half the objects were studied 'actively' such that the objects could be rotated by the participants about any axis in real time using the track ball. The other half of the objects were studied 'passively'. For passive viewing, active exploration of sequences of other, yoked, participants were played back during familiarization. Twenty seconds were allowed for exploration of each object regardless of the study condition. During the test session, participants were presented with 160 randomly organized object images: four views of the 20 study (old) objects and four views of 20 unstudied (new) objects. Recognition was tested via an old/new task and response time and accuracy were recorded. Results indicated that participants recognized objects that were explored actively significantly faster than objects that were viewed passively ( $p < .005$ ). Thus, the formation of representations of the novel 3D objects was influenced by whether or not one could influence the visual input during familiarization. Specifically, self-directed exploration of objects resulted in faster recognition than when objects were passively viewed. Supported by a NSERC Research Grant to GKH and a MRC Research Grant to MAG.

## **8. Adult Supraliminal and Subliminal Similarity**

### **Judgments Compared with Supraliminal Similarity**

#### **Judgments of Preschool Children**

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Two types of similarity, attributional and relational, have been widely recognized. This study compares attributional vs. relational similarity judgments made by 58 adult participants on items presented in 2 conditions, subliminal and supraliminal; and by 58 preschoolers presented the same items supraliminally. Two questions are addressed: 1) Can similarity judgments be made on items presented outside of consciousness? 2) Is there a developmental shift in the nature of similarity categorizations from attributional to relational? Results suggest affirmative answers; adults made relational over attributional similarity judgments, supraliminally at the p<.000 level, and subliminally at the p<.014 level; whereas children made attributional over relational judgments supraliminally at p<.000 level.

## **9. The Functional Neuroanatomy of Implicit and Explicit Semantic Self Knowledge.**

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We studied the functional anatomy of implicit and explicit semantic self-knowledge with functional magnetic resonance imaging (fMRI). Words were used as stimuli in two experiments (exp.). In the first experiment, subjects made explicit decisions about physical and psychological trait adjectives describing their own attributes, while in the second exp., subjects made an implicit judgement about physical / psychological trait words. When subjects made explicit judgements, activation was present in the precuneus, the left parietal lobe, left insula/inferior frontal gyrus and the left anterior cingulate. Activation coincident with implicit judgements, occurred in the left inferior frontal gyrus, the right inferior parietal lobe, the right middle and the left superior temporal lobe. A reaction time advantage was present in both verbal experiments when subjects responded to self-relevant words. The results suggest the engagement of long term and working memory as well as semantic processing and emotional components

## **10. Measuring Mental Operations**

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What do the words 'I am conscious of (something) mean? Do words like 'aware' or 'perceive' represent different mental operations? Is an operation the same mental state for all of us? How do we characterize our mental operations and is this characterization different from our actual use? Answering these questions is difficult because these words arguably represent a class of cognitive operations whose product is usually an experience (e.g. awareness) rather than verifiable product (e.g. a solution to a mental problem or a memory). Two approaches to characterizing and comparing experiential mental operations were tried: (1) The mental operations described by the words 'see', 'perceive' and 'conscious of' were rated by participants on an analogue scale according to the relative amount of time required for each. For 183 participants, all within-subject comparisons were significantly different with see < conscious of < perceive. (2) A response time experiment with multiple trials and conditions was used to measure the durations of the mental operations in a separate group of 85 participants. On each trial participants received an instruction to "Press the mouse key immediately after you\_\_\_\_the (stimulus)," with one of either 'see, perceive, or are conscious of inserted at the blank. Response times were different from ratings, with 'see' significantly briefer than the other two, and with consciousness taking the longest (325, 369 and 382 milliseconds, respectively). The evidence suggests that the words represent different operations, with commonality of meaning across people, and with their understanding somewhat different from use.

## **11. Attention, Stimulus Quality, and Awareness**

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Whether a stimulus is perceived with or without awareness is determined by both the allocation of attention to the stimulus and the quality of the stimulus information. To assess the conjoint effects of attention and stimulus quality in determining the likelihood that a stimulus is perceived with or without awareness, participants were shown visual displays consisting of a target word flanked by two digits (e.g., 2 chair 5). Allocation of attention was varied by having participants ignore, repeat, or add the flanking digits, and stimulus quality was varied by presenting the target words for different exposure durations. Each display was followed by the stem of the target word (e.g., cha \_\_), and participants were instructed to complete each stem with any word other than the target word. Whenever the participants used the target word to complete the stem despite these instructions, it was assumed the target word had been perceived without any awareness of perceiving. Conversely whenever the participants did not use the target word to complete the stem, it was assumed that the target word had been perceived with awareness. For low levels of stimulus quality, the visual displays were perceived, but variations in attention had little or no effect on whether the displays were perceived with awareness. In contrast, for intermediate to high levels of stimulus quality, there was a

general compensatory relationship between attention and stimulus quality such that an increase in either attention or stimulus quality increased the likelihood that the displays were perceived with awareness.

## **12. Headwaters Of The Stream Of Consciousness**

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This study examined participants' knowledge of the sources of thoughts in their stream of consciousness, in an attempt to demonstrate a hypothesized unconscious process in thought generation. Twenty-five Ps each wrote out their stream of consciousness for ten minutes. A recording of scripted speech and selected music, ostensibly from a radio broadcast, was played in the background while the participants were writing in an attempt to introduce content into Ps' cognitions artificially. The experimenter examined each participant's completed text and, in the event that an idea resembling content from the recording had surfaced, asked them to identify the origin of that idea. Any statement similar to the recording content was judged to have been inspired by the recording if it was written soon after the content appeared in the tape segment. Artificially-introduced content did indeed surface in many Ps' texts. The majority of participants who included content from the tape in their stream of consciousness were unable to identify the relevant cognition's source as having been related to the stimulus. They instead produced false attributions to the ideas to a variety of other normally plausible sources. We conclude that content generation in the stream of consciousness is, at least in part, outside the grasp of conscious awareness. Ps believe they know the sources of their thoughts however, as demonstrated by the credence they lend their false metacognitions. This illusory "awareness" may belie an unconscious mechanism for generating the content of spontaneous verbal thoughts.

## **13. Mental rotation and object recognition: Let's get real**

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In an influential series of experiments, Jolicoeur had subjects name line drawings of objects rotated in the picture plane (Memory & Cognition, 1985). As objects were disoriented from their usual 'upright', naming time increased linearly (between 0° and 120°). The effect of orientation was large in the initial block, but smaller in later blocks. Jolicoeur proposed that the initial effect reflects a 'mental rotation' operation that normalizes the input to match the memory representation. He also proposed that learned associations between the objects and orientation invariant 'features', such as colour, may play a role in the improved naming of disoriented objects seen in later blocks. We evaluated this idea by comparing the orientation effect across 3 surface conditions (line, grayscale, colour). Subjects named 54 images (18 line, 18

gray, 18 colour) of common, manufactured objects rotated 0°, 60°, 120° from their usual 'upright' across 3 naming blocks. The orientation-effect was measured as the slope of naming time over orientation. We found that naming time for objects in the 3 surface conditions did not differ at 0°, but did when objects were disoriented. Importantly, on the **first** naming block the slopes of the latency over orientation function was shallower for colour images (.26 ms/deg) than for grayscale (.83 ms/deg), or line drawings (1.29 ms/deg). In a second experiment we replicated, with a larger sample of objects, our findings of a shallow latency over orientation function for colour images even in the first block (.45 ms/deg). In a third experiment, subjects named coloured images of objects at the subordinate level, as this has been shown to increase orientation-effects on recognition tasks (Hamm & McMullen, JEP:HPP, 1998). To test the idea that learned colour cues reduce orientation-effects we also changed the colour of half the objects across blocks, and left the colour of the other half constant. We found only minimal orientation effects even in the first block (.41 ms/deg), and no effect of the colour manipulation. **Conclusions.** The results suggest that colour reduces the need for mental rotation. It does not appear the reduced need for mental rotation depends on the learning of colour cues during the experiment. When rich visual information is available, as in the real world, mental rotation may not be necessary to recognize disoriented objects.

## **14. The Role of Cue Patterning in the Metacognitive Selection of Contextual Information**

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Inconsistent findings in the context-dependent memory literature comprise the empirical starting point of a theoretical discussion regarding potential factors contributing to the salience of contextual information as it relates to the successful completion of cognitive tasks such as learning. Previous empirical findings suggest that the human mind often selects cues for the retrieval of information based upon a rigid, pre-determined hierarchy, frequently disregarding useful contextual cues in favour of list or copy cues. Instances are explored in which exceptions to this rule occur. For example, threatening, unique, or otherwise prominent contextual cues can override the bias toward semantic cue selection. Because they are largely due to genetic predispositions, these examples are less interesting, and less experimentally useful, than the potential influence of contextual cues that are less dramatic, but nonetheless demanding of attentional resources. Drawing from environmental psychological principles, many factors are named that contribute to the salience of contextual cues, the most important of which is the integration of the context with the observer and the integration of both with the task or mental operation at hand. Such integration is referred to as "contextual integration" and may represent a prime order contextual factor for use as a metacognitive indicator of personal relevance. Contextual integration is further described as

the product of an elaborative process whereby experiences become imbued with a distinct "feeling" of the type associated with most of life's rich, meaningful, significant, and memorable personal events.

### **15. Implicit Processes in Sentence Generation**

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Implicit processes in sentence generation during casual conversation were investigated. In the first attempted method, the experimenter randomly interrupted conversations of people around the university campus with questions such as, "What will your last word/phrase be?" This method proved to be too disruptive (i.e., people were often startled by being approached by a stranger). In the second method, we recruited various acquaintances to agree to being randomly interrupted by a prearranged signal during conversation over a period of about three weeks. Results show that people were unable to report their intentions for speech, indicating a strategic unconscious influence in sentence generation. We found that a presence of clausal boundaries between interruption and the intended assertion predicted failure. People were able to report their "last assertion" if they were interrupted in a clause, and could only report the end of that particular clause. Finally, further investigation of tapes of discourse showed that consistent intentions are maintained in speech, even if people are unable to conscious access the intentions. Implications of this study for the capabilities of the unconscious in higher-level cognitive processing will be discussed.

### **16. Recognizing Expression From Familiar and Unfamiliar Faces**

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The aim of this study was to clarify the relationship between accessing the identity of a face and making decisions about its expression. Four experiments are reported in which undergraduate subjects made expression decisions about familiar and unfamiliar faces. The decision was slowed either by concealing the mouth region with a black rectangle (experiment 1) or by using a short presentation time (experiment 2, 3 and 4). Results of experiment 1 showed that subjects better recognized the displayed expression of celebrities than of unknown persons when information from the mouth was not available. Results of experiment 2 showed that they recognized more easily the expression displayed by celebrities when the presentation time was short. Experiment 3 and 4, using familiarized faces, replicate the results of experiments 1 and 2 and rule out a possible explanation of these results by the use of some identity specific representations that are expressive. Implications for face recognition models are discussed.

### **17. Aging and the Automaticity of Face-Name Categorization**

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Studies using the traditional Stroop color naming task or picture-word variants consistently show that an incongruous word interferes with color or picture naming, but an incongruous color or picture does not interfere with word reading. We developed a face-word Stroop analogue in which human faces (male or female) and animal faces (cat or dog) were paired with a congruent proper name (e.g., female face - BETTY; dog face - FIDO) or an incongruent proper name (e.g., female face - DAVID; dog face - SOCKS). Young and older participants were asked to categorize human faces or names as man/woman and animal faces or names as cat/dog. In this face-word categorization task, incongruous human face-name pairs produced similar levels of interference in the picture categorization and word categorization trials. For incongruous animal face-name pairs, faces interfered more with the name categorization task than vice versa. This latter finding can be attributed to the cat/dog category being more accessible for the faces than names and therefore, faces producing more interference than the cat/dog names utilized in this study. Contrary to the view that older adults have greater difficulty in suppressing irrelevant information, no significant age-related differences in interference were detected. We will discuss the implications of these findings for the automaticity of retrieving basic category information.

### **18. The Structure Of Emotion: What You See Is What You Do.**

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How do we understand the emotion portrayed by the artist in visual representations? Lipps' (1900) theory of empathy in art suggested that we come to associate visual patterns with our own internal states. Gestalt isomorphism (Kohler, 1929) was invoked by Arnheim (1945, 1974) to explain the correspondance between an internal kinaesthetic code and visual structure in the portrayal of emotion. Laban (1978) likewise described a visual-kinaesthetic correspondance in the perception of dance movements. More recently, Bertenthal and Pinto (1991) has suggested a similar mechanism, which they call biological complementarity, to explain the very young infant's ability to imitate, as well as to discriminate human movement patterns. Freyd's (1987) work reveals that the perception of visual dynamics is also apparent in static visual displays. Thus, it is possible that our perception of visual structure is based on a dynamically structured kinaesthetic code, as Arnheim has suggested. Rhyne (1993), an art therapist, demonstrated structural similarities

in the way people put lines on paper when asked to make abstract line drawings portraying specific emotions. I have asked approximately 4000 students in various undergraduate classes to make representational drawings of six situations which correspond to the six universally recognizable emotions as identified in Ekman's (1971) work on facial expressions. The structural characteristics of the drawings show reliably consistent representations of sadness and happiness in particular, but also of surprise, disgust, anger and fear. The neurophysiological basis for the correspondence between kinaesthetic and visual structure in emotion remains to be explored.

### **19. The Role of Emotional Experience in Development of the Sense of the Subjective Other.**

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Emotional experience functions as an internal signal that guides human action, directing choices and decision-making behavior in the lived environment. Throughout the learning history of the organism, undifferentiated emotional signals become associated with more complex cognitive representations to generate emotional schemata. These, in turn, shape the meanings of experiences, imbue them affective tone, link them to our autobiographical histories and give them status in a hierarchy of motivational priorities, aims and goals. But emotional experience is not solely an intra-individual affair. It is constituted in social contexts in the exchange of emotional signals between individuals. At a very early stage in the course of development, the meanings of these internal signals become differentiated and linked to more complex schemata in the inter-individual process of emotion reciprocation and regulation between caregiver and infant. The meanings of subjective feeling states and their associations with situations, agents, and objects are shaped in a process in which two individuals - a caregiver and a child - enter into a communicative exchange of mutual affect. It is argued that emotional experience is one of the key means by which our understanding of others as mental and experiencing agents develops. Evidence from studies of infant-caregiver interaction, of the neuroendocrine systems underlying attachment behaviors, of the role of emotional schemata in affect regulation, and of facial affect contagion are presented to support these claims.

### **20. Eros And Self: Iamblichus On The Paradoxes Of Consciousness**

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Iamblichus of Chalcis (c. 240 – c.325 A.D.) was the last great philosopher of pagan antiquity. He based his comprehensive psychology and cosmology on a synthesis of Pythagoras, Plato and Aristotle, interwoven with

conceptual elements derived from Egyptian, Assyrian and Greco-Roman philosophic traditions. With the Christianization of the Roman Empire most of his writings were destroyed, and his work fell into neglect for many centuries. Recent scholarship has permitted the reconstruction of Iamblichus' views. Although couched in the technical terminology of theurgical Neoplatonism, the Iamblichean system contains ideas that are surprisingly fresh and relevant to modern debates on the nature of consciousness. Iamblichus' position is monistic; he defines such terms as body (*soma*), mind or soul (*psyche*), spirit (*pneuma*) and matter (*hyle*) as contextually conditioned aspects of a fundamentally seamless totality. The structure of the self is seen as intrinsically divided and conflicted by virtue of the fact that the individual is simultaneously identified with a finite part and an infinite whole. *Eros* is the word used by Iamblichus for the dynamism imparted to life by this conflict. Each facet of the self manifests as distinctive modes of perception, volition, imagination and memory. Friction between the facets gives rise to the unique character of human consciousness. Maturation into wisdom depends on one's navigation of the paradoxical self-schema's consequences.

### **21. Conscious Recollection And Feelings Of Familiarity For Studied Threat Words As A Function Of Trait Anxiety.**

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Williams, Watts, MacLeod and Mathews (1980) have proposed that anxiety is associated with a cognitive bias occurring in preattentive automatic stages of processing (implicit memory) rather than in later strategic processes (elaboration). In a test of this idea Moog, Gardiner, Stavrou and Golombok (1992) used the remember/know procedure proposed by Tulving (1985) as a method for investigating states of consciousness underlying mnemonic experience. They hypothesized that anxious participants would show a relatively larger proportion of know responses to threat words if there was selective automatic activation of threat representations. However the results did not demonstrate any between group differences for either type of response. Experiment 1 was an extension and replication of this study using trait anxiety. Two forms of encoding were explored perceptual and semantic, and positively valenced words were added along with both social and physical threat words. Know responses were calculated using the assumption of independence between the two types of responses, the earlier study had used the exclusion assumption which tends to underestimate the number of know responses. This study also included depression as a covariate. In general the results confirmed the earlier study in failing to find any between group effects of anxiety on remember or know recognition responses, however analysis of false recognition responses revealed that high trait anxious subjects made significantly more false remember responses to words with affective

meanings. These results were interpreted as suggesting that anxious subjects seem to be more subject to falsely recollect elements of emotionally charged experience. A second experiment replicated the first in a simplified design and also found that the effects of Anxiety Sensitivity led to similar results.

## 22. Machine Self-Reference and Consciousness

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Kurt Goedel, inspired by Epimenides' Liar Paradox, mathematically formalized the construction of self-referential sentences. Stephen Kleene, inspired by Goedel's formalization, provided, by his Strong Recursion Theorem, an analogous mathematical formalization of self-referential machines, algorithms, or computer programs.

Kleene's result has had many applications in computability theory. It also includes as special cases ordinary programming language recursion and Brian Smith's programs which can examine their own traces. The general case of Kleene's theorem provides for programs/machines each of which externally projects and treats as data a complete, low level model of itself (i.e., program text, flowchart, wiring diagram, ...). The external projection avoids infinite regress.

To understand Kleene's result, picture a transparent robot looking in a (reversal corrected) mirror at its own underlying mechanism so that it can subsequently take into account as data for its further computations, among other things, its own mechanism.

The present paper is an analysis of machine self-reference as an idealization of the self-modeling component of human consciousness. Human self-modeling (at any level) is rather poor (but vastly better than self-modeling in other animals). The paper explores the discrepancy between the achievable machine ideal of perfect (low level) self-modeling (as from Kleene's theorem) and the poorer human case.

It will also analyze the manner in which the separation above between

1. the externally projected self-model and
2. the machine so-modeled and doing this projection applies to the human case. In particular, it will specify a human analog of the mirror metaphor above.

## 23. The Ecological And Dispositional Self: From Prereflextive Beginnings To Higher-Order Consciousness

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Narrativist accounts of the self rely on a subject treating itself as an object of thought, thereby associating this form of selfhood with higher-order consciousness. In the past decade Ulric Neisser (cf. 1988) and others have argued

that the foundation for the self can be found instead in forms of self-specifying information which rely on direct perception and not on conscious reflection. Paradigmatic cases are forms of bodily awareness relayed by optical flow patterns and proprioception. I wish to argue that the basis of the self must be sought even earlier, on a prereflexive and purely behavioral level; the reason being that otherwise we have no means of explaining why, say, phantom pains are a pathology of bodily self-awareness. An intuitive answer would be that phantom pains are pathological since a subject reports having sensations in a part of his body, which in another sense is not a part of his body. The presentation will develop a concept of the self with ecological and dispositional aspects (the self as a bearer of physical and intentional properties), presenting various alternatives for the prereflexive foundations of both. A further focal point will be a discussion of the conditions necessary for the development of phenomenal and higher-order consciousness and their effects on the self thus conceived.

## 24. Phenomenology and Dynamical Neural Networks: Modelling Self as an Emergent Property

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A fundamental premise of phenomenology is that our immediate intentional relation to the world is pre-predicative, in that it has a structure different from the subject-object form of language and thought. A proper phenomenology of this level of experience shows that we experience objects indeterminately when we are perceiving them or moving toward them. Current cognitive science models of perception and action, however, assume that the objects that we move toward or perceive are represented as determinate in our experience of them. In this presentation, we propose simple dynamical neural network models of movement and perception that capture the indeterminacy characteristic of the pre-predicative level of experience. Taking these models as the starting point of theorization, it is suggested that the neural correlate of predicative acts, such as assertions and judgements, are embedded in and evolve from this level of experience and are not considered as isolated, autonomous acts of a representing subject. With this formulation, the idea of self, as with all predicative concepts, evolves as an emergent structure from the neural correlate of pre-predicative experience.

## 25. The Self Is Spatial but Not Experienced as Spatial, or The Strange Plight of Manifold Mole

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According to Colin McGinn, consciousness is not "the kind of thing that falls under spatial predicates" (p. 149-

150).

In response, I claim that the self can be construed to be spatial but its spatiality cannot be experienced. In particular, a subject cannot experience the spatiality of his/her self. Using elementary set theory, I argue that the spatiality of the self is too complex to be experienced. A fictional being by the name of Manifold Mole is cooked up to facilitate my argument. Mole has only one mental faculty. It experiences heat on the surface of its body due to a finite number of heat sensors distributed over this surface. Each sensor allows Mole to experience a heat patch. At any one time, Mole can experience any combination of heat patches. Over time, Mole's self is constructed out of all its experiences of combinations of heat patches. So Mole's self is spatial; it can be described by spatial predicates. It turns out, I argue in the paper, that elementary set theory can be used to show that Mole's self is too complicated for Mole to experience, even though Mole's self is constructed out of Mole's experiences. Does Manifold Mole's plight apply to conscious beings like ourselves? This paper additionally argues that, with appropriate caveats, it does.

McGinn, Colin 1995. "Consciousness and Space". In Thomas Metzinger, ed., *Conscious Experience*. Schöningh: Academic Press.

## 26. Reading Minds: strong AI and the I CHING

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This paper extends a simple technique to speed up flowchart programs, first described by Bird (1975), into a formal procedure for the elimination of all finite length variables from any flowchart program.

It will be shown that the resulting, variable-less flowchart program, is isomorphic to a particular type of text, T, with the act of reading T being an analogue of program execution.

Then, equating the text, T, to any Strong AI flow-chart program, Q, I will show that conceding the Strong AI thesis for Q (crediting it with mental states and consciousness) opens the door to a vicious form of pampsynchism whereby the act of reading is sufficient to invoke "textual consciousness".

It is further shown that such a notion (of text-consciousness) can be traced back at least 5000 years, and is grounded in the ancient Chinese philosophy of the I CHING (Jung, 1949), being discussed more recently by Hofstadter (1981).

Bird, R., (1975), Programs and Machines, J.Wiley, UK.

Hofstadter, D.R., (1981), A Conversation with Einsteins Brain, in Hofstadter, D.R. & Dennett, D.C., (1981), *The Mind's I*, Penguin.

Jung, C.G., (1949), Forward to, Wilhem, R. (1923), "I CHING or book of changes", (English translation, Baynes, C., 1950, Penguin).

## 27. A Model of Emergent Self

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Ramachandran (1995) described a woman with a paralyzed hand who denied her paralysis (anosognosia), sometimes resorting to rather sophisticated mental tricks. Placing cold water in her ear reversibly changed both the woman's perception of her present condition and her memory about the past. How was this reversible alteration possible? Why do cases like this seem so strange to us? The answer clearly relates to what we subjectively take to be the features of a normal state of conscious awareness that can be revealed by introspection: "there is only one real 'me'; I possess a free will", etc. Whom does a person call 'I'? What and where exactly is that? Careful analysis leads to an answer that the domain of existence of the person's 'I' understood as the subject of awareness is this person's internal cognitive model (ICM) of the world. We define an ICM as a dynamical model of a particular cognitive system (e.g., brain, computer), which at the same time is a formal language representing a particular system of knowledge and beliefs about the world, including itself. A notion of 'I' together with its subjective features is defined as a system of axioms within an ICM. Implementation of these axioms as dynamical constraints results in the emergence of 'Self' in the cognitive system at a holistic level. The model is used to give an account for paradoxical consciousness disorders such as hemineglect and anosognosia and suggests a basis for understanding the specific functional role in consciousness of the prefrontal cortex.

## 28. Consciousness And The Inner-Outer Metaphor.

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The terms "conscious content" and "external world" have obvious spatial connotations. But the external world, in the usual epistemological sense, is not spatially external to the subject since it includes the physical human body. Conversely, in the ordinary spatial sense of "in", conscious contents are not in the person who owns them. It is also not true that all physical objects, but no conscious contents, are experienced as being spatially external to the subject. For example, I experience most visual sense-data, but not my brain, as being "outside" me.

One main source of the use of spatial metaphors in epistemology is a failure to understand the nature of internal perceptions, i.e., perceptions stemming from, and subjectively being referred to, one's own body.

Phenomenologically, such internal perceptions are usually different from external perceptions in that they less often have a purely physical intentional object: while a visual perception of a tree usually does not take the visual sense-datum as an intentional object, an experience of a bad tooth usually involves attending to a pain, not only to the tooth. However, this contingent phenomenological difference

does not reflect any essential epistemological distinction between external and internal perceptions. The privacy of internal perceptions, which is simply due to the way our nervous systems are wired, is surely also a contingent matter. If the two mentioned features of internal perception are not properly understood, they may be mistaken for fundamental epistemological facts concerning "inner" conscious contents.

## **29. Awareness Of Deficit After Brain Injury In An Early Phase Of Rehabilitation- The Role Of Memory, Perception And Attention Deficits**

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The paper will present the development a stepwise examination process of the awareness level for patients following brain injury. 61 patients (SAH, TBI and others) were interviewed and neuropsychologically examined. In initially free, and later semi-structured interviews, the perceptual difficulties were assessed. In the following step the patients were required to complete a self assessment, using a concrete scoring system before and after carrying out a set task. All lesions were controlled by MRI.

In the initially free interview (step 1) somatic difficulties were reported. However but not all existing somatic difficulties (e.g. hemiparesis) were reported. In the semi-structured interviews (step 2) a few more cognitive difficulties were reported. Different levels of consciousness in different areas were observed before and after the completion of the set tasks (step 3). Some react first after completing the set of tasks. They can use the information as a form of feedback. The best scoring of all patients exist in the area of the verbal learning task. Whereas the scoring of the reaction time and the divided attention task are mostly not adequate.

An important significance is seen between the association of working memory, complex visual perception abilities and different levels of awareness. The form of interview and questioning is one factor which influence the answers in an significant way. Although lesions unilateral in the thalamus of the right hemisphere or the frontal lobes fail to reach statistical significance, there are considered as an important factor.

## **30. Electrophysiological Testing in Comatose Patients**

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Cerebral-cortical function in a comatose person with preserved cranial nerve reflexes is clinically inaccessible. However, electrophysiological testing allows: (a) a broad

categorization into types of dysfunction, (b) trending of worsening or improvement, (c) monitoring response to therapy, (d) determination of the severity or degree of dysfunction and, with the inclusion of clinical information, (e) prognostic determination in many cases.

We have developed an EEG classification system for coma that includes an assessment of electrographic reactivity. This shows a high degree of inter-rater reliability (kappa score >0.90) and, with inclusion of clinical variables for specific categories of disease, show promise in determining prognosis for recovery of consciousness or for outcomes no better than the persistent vegetative state (positive predictive values >0.80). For anoxic-ischemic encephalopathy, the addition of somatosensory evoked response testing has increased the prognostic utility of electrophysiological evaluation.

The results of a 10 year prospective study of comatose patients in the intensive care unit, in which we correlate the EEG and clinical features with outcome, as well as a study of the comparative utility of EEG and somatosensory evoked potential testing in comatose survivors of cardiac arrest, will be shown.

## **31. Specific Alterations in Consciousness Following Traumatic Brain Injury: Reexamining Personality Change**

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The behavioural changes that follow Traumatic Brain Injury (TBI), particularly to the right hemisphere, are predominantly characterized as personological. They are personological in that the patient's premorbid personality was dramatically changed by the TBI (Prigatano, 1992). This paper proposes an alternative perspective by which the behavioural changes following TBI can be viewed. The behavioural sequelae of TBI are manifested as changes in the ways that the patient relates to both his social milieu and him/herself. These changes indicate a profound change in the patient's consciousness of others and of themselves. These changes in consciousness can be operationalized in terms of performance on measures of "theory of mind" that involve representing the mental states of themselves and others. Changes in self awareness can be specified as the ability to track their own mental states, and the fact that their own representations can change and conflict. Both changes account for their failure to participate competently in pragmatic discourse. Changes in the patient's ability to represent changes in their own mental states is manifested as "anosognosia" or an unawareness of their deficits. This paper will integrate recent research revealing theory of mind deficits in adults with TBIs, functional neuroimaging studies (Happe et al, 1996) and the author's pilot data on the theory of mind deficits in children with TBI (Ramsay, Homer & McFadden, 1999). The converging evidence from

these studies will be used to outline a general framework for mapping changes in consciousness following traumatic brain injury to specific models of neurological functioning.

Happe, F; Ehlers, Stefa; Fletcher, P; Frith, U; Johansson, M; Gillberg, C; Dolan, R; Frackowiak, R; Frith, C. (1996) 'Theory of mind' in the brain. Evidence from a PET scan study of Asperger syndrome. *Neuroreport:-An-International-Journal-for-the-Rapid-Communication-of-Research-in-Neuroscience*. Dec; Vol 8(1): 197-201.

Prigatano, G.P. (1992) Personality and psychosocial consequences of brain injury. In Meier, M., Diller, L, & Benton, A. (eds.) *Neuropsychological Rehabilitation*. London: Churchill Livingstone.

Ramsay, J.T, Homer, B.D. & McFadden, G.T. (1999). An Examination of Social Cognition Following Pediatric Acquired Brain Injury. *To be presented at the International Conference on Pediatric Neuropsychology, Palm Beach, FL, February 24-28*

## **POSTER SESSION 2**

### **1. Visual Awareness of Objects as Revealed by EEG.**

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The aim of the present study was to shed more light on the neural correlates of visual awareness by examining event-related potentials (ERPs) during an object detection task. The present EEG study was a replication of the MEG study by Vanni et al. (1996). Here we report the results from ten right-handed healthy adults. Two types of black-and-white line-drawings were used in the study as stimuli: objects and non-objects. The pictures of objects were selected from the standardized stimulus set of 260 pictures by Snodgrass and Vanderwart (1980). The corresponding non-objects were selected from the stimulus set of scrambled objects that was used and generated by Vanni et al. (1996) by randomly rotating circular areas within the object drawings until the object became completely disorganized and unrecognizable. Three different stimulus durations were used to vary the rate of conscious object detection; the masked stimuli were presented for the participant below, at, and above the recognition threshold in consecutive sessions. After each stimulus the participant responded by pushing one key if he had seen a coherent object, another key if he had seen a disorganized non-object, and a third key if he had failed to see whether the stimulus was an object or a non-object. While the participant was performing the task, EEG was recorded using 20 scalp electrodes (Ag/AgCl) arranged according to the 10/20 system.

The main finding was a prominent negative ERP-component that occurred at around 270 ms after stimulus onset for all consciously perceived stimuli shown at or above the recognition threshold, but not for any stimuli shown below the threshold. This component seems to correlate with the crossing of the recognition threshold and

it might reflect the neural correlates of visual awareness or be a necessary condition for visual awareness to occur.

1 Snodgrass; J. G., & Vanderwart, M. (1980). A Standardized Set of 260 Pictures: Norms for Name Agreement, Image Agreement, Familiarity, and Visual Complexity. *Journal of Experimental Psychology: Human Learning and Memory*, 6, 174-215.

2. Vanni, S., Revonsuo, A., Saarinen, J., & Hari, R. (1996). Visual awareness of objects correlates with activity of right occipital cortex. *NeuroReport*, 8, 183-186.

### **2. Assessing Attentional changes in Long-Term Mindfulness Meditators Using a Cued Attention Task and Event-Related Brain Potentials.**

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Using techniques from cognitive neuroscience, we tested the claim that mindfulness training alters the attentional capacity of the practitioner. Thirty individuals engaged in a cued visual attention task while EEG was recorded: long-term mindfulness meditators, long-term practitioners of musical instruments, and age, sex, and education matched controls who have neither practiced meditation nor music. While all three groups exhibited comparable reaction times when a target occurred in the attended field, meditators showed little or none of the usual reaction time slowing when the target appeared in a non-attended field or when the cue was ambiguous. This difference in attentional "cost" was most pronounced when the target appeared in the left visual field. Significant differences were also observed in the early components of the ERP. Overall meditators displayed a larger negative peak in the region from 120-180 msec. to all conditions: attended, non-attended and neutral. However, most pronounced was the presence of a larger peak in meditators when targets appear in the non-attended field or when the cue was neutral. Meditators and controls also displayed a smaller positive-going wave in the region of 400-750 msec. to the targets relative to musicians. These results suggest that musicians and non-practicing controls display the expected "spotlighting" of their attention to the cued location and that this results in the need to shift attentional resources when the cue appears in a non-attended location. In contrast, long-term mindfulness meditators appear to maintain a "distributed" focus of attention which is affected less by cuing.

### **3. Meditation: A conscious state distinct from rest and sleep – evidence from PET, EEG and observations.**

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Consciousness has different aspects. Some such as experience of control over one's behaviour and mental state or volition are executory. Other aspects like awareness of

the world through senses are perceptory (1).

Relaxation meditation induces an experience of loss of motivation, emotion and voluntary control with a concurrent increase in subjective sensory and conceptual experience (qualia). Likewise induction of sleep generates loss of voluntary control and is accompanied by a substantial loss of perceptory awareness. During this state vivid dreamlike often emotionally charged hypnagogic experiences may occur – restricted to conceptual processes. Thus from an experiential perspective the consciousness aspect in meditation is distinct from the broadness of the awake state and the narrowness of light sleep.

We have previously investigated relative regional cerebral blood flow during relaxation meditation in 7 experienced yoga teachers (2). We found a relative decrease in frontal, subcortical and cerebellar rCBF during meditation, and conversely, an increase in post-Rolandic association cortices using O15-labeled water PET. Activated areas were largely symmetrically located in both hemispheres. This activity pattern resembles measures during REM sleep (3) with the noticeable difference that the latter was accompanied by high anterior cingulate activity, presumably related to the emotional quality of dreams. The relaxed meditative state investigated in this study turned out to be accompanied by relative frontal hypoactivity as seen in REM sleep – another state of reduced quantitative consciousness. This result is not surprising seen in the light of the EEG-changes known to occur during meditative relaxation.

The previously applied method can only measure flow distribution not absolute flow. We have therefore now measured absolute blood flow in a few additional subjects. This revealed unchanged absolute flow from rest to meditation, similar to what is known from light sleep, while deep sleep is known to be associated with decreased absolute flow. The relative flow distribution was the same as seen previously.

When subjects lay to rest with closed eyes the activity pattern of the electroencephalogram (EEG) shows increased posterior alpha activity. As the subjects fall asleep this activity by definition is reduced by 50%. The theta activity on the other hand increases. During meditation we found significant increase in theta activity (11%, p<0.05, Wilcoxon sign rank test), but with no significant change in alpha activity (-2%).

In summary we find, that the parameters considered are in agreement with meditation as a state of consciousness distinct from the states of awake restfulness and light sleep.

1. Posner (1998) Philos Trans R Soc Lond B Biol Sci, 353, 1915-27.
2. Kjaer & Lour (1998) Consciousness Research Abstracts, Tucson III, 1998.
3. Nofzinger et al (1997), Brain Res, 770, 192-201.

#### **4. Self in Threatening Dream Events.**

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Dreaming is the most frequently occurring altered state of consciousness. In the present study we tested the

evolutionary hypothesis of the function of dreaming that dream consciousness is a mechanism for simulating threat perception and rehearsing threat avoidance behaviours (Revonsuo, in preparation). Thus, we developed a rating scale for analysing the content of threatening events in dreams. The data consisted of about 600 dream reports in the home-based dream diaries of 52 students, rated by three independent judges. We hypothesized that in order to efficiently simulate real threats to the survival of the dreaming individual the threatening dream events should be centered on the Dream Self.

The results show that Dream Self is the most frequent target of threatening events in dreams; that the threats encountered in dreams are often much more severe than the ones encountered in waking reality by the same subjects; that in most events the Dream Self is actively trying to do something about the threat, and that the threatening events do not cause any substantial damages or losses to the Dream Self. There was a positive relationship between the severity of and the reaction to the threat: the more life-threatening the event, the more likely the Dream Self was to act in a relevant way to defend itself or others against the threat. In conclusion, our results revealed that threatening events in dreams are frequent, quite severe, and centered on the Dream Self. Dreaming as a state of consciousness may thus have served as a mechanism for the simulation of threatening events and threat avoidance behaviours in human evolutionary history.

#### **5. Binding and the Phenomenal Unity of Human Characters in Dreams.**

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The notion of the "bizarreness" of dreams is closely related to the concept of "binding" in consciousness research. Dream bizarreness can be reconceptualized as referring to different types of failures or errors in the binding of dream images coherently together. The present study concentrates on one specific type of phenomenal elements in our dreams: the representation of human characters in dreams and the bizarreness found in these representations. We developed a rating scale that distinguishes different types of bizarreness on the basis of the kinds of binding errors that are manifested in the dream images. The data consisted of 592 dream reports in the home-based dream diaries of 52 students, rated by three independent judges.

The results indicate that a large proportion of the human characters appearing in our dreams contain bizarre elements, but some types of bizarreness are more frequent than others. The structure of the visual representation of a dream person remains almost always intact while the semantic knowledge associated with the representations is more often inappropriate. Phenomenal features intrinsic to the representation of a person (visual outlook, familiarity, semantic knowledge) are less frequently bizarre than is the external relation between the person and the context (e.g. the place). Thus, binding the local features of a representation coherently together appears to be less prone to errors than binding several different representations

together into a coherent model of the world.

We conclude that the weirdness of dream images, i.e. the errors in binding different information sources together to produce coherent phenomenal representations, may shed light on the mechanisms involved in the construction of unified phenomenal objects and the unified phenomenal world that we normally enjoy in waking perception.

## **6. Sleep Paralysis and Associated Hypnopompic and Hypnagogic Experiences: Basic experience and subsequent elaboration.**

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An anomalous REM sleep state known as Sleep Paralysis (SP) is a unique natural laboratory for the study of consciousness. SP occurs just before waking or falling asleep. During SP, one is fully conscious but unable to move. Moreover, one is susceptible to Hypnagogic and Hypnopompic experiences (HHEs) in visual, auditory, and kinesthetic modalities. Strong feelings of fear and, less frequently, bliss are also common. We have developed and tested a model of SP and associated HHEs using two large samples who were administered the Waterloo Sleep Experiences Questionnaire (Cheyne, Newby-Clark, & Rueffer, 1998; Cheyne, Rueffer, & Newby-Clark, 1998). Consonant with the activation-synthesis model of dreaming (Hobson & McCarley, 1977), we predicted and found that SP with HHEs consists of three components: (a) alien intruder (AI), (b) incubus (INCUBUS), and (c) unusual bodily sensations (UBE). We now further explore the relations within the three components. Consistent with our overall framework, we argue that more rudimentary HHEs are subsequently elaborated into more complex thoughts and sensations. For all three components, path analyses substantiated our hypothesis ( $N = 704$ ). For the AI component, the vague sense of a nearby presence was subsequently elaborated into visual imagery, fear, and auditory hallucinations. For the INCUBUS component, a reported difficulty in breathing was elaborated as feelings of pressure on the chest, pain, and thoughts that one might die. For the UBE component, a sensation of floating was translated into out-of-body experience and bliss.

## **7. The Elaboration of Anomalous Conscious Experiences: Individual Differences in Hypnagogic and Hypnopompic Hallucinations during Sleep Paralysis**

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Our previous research demonstrated that certain classes of anomalous conscious experiences arise from specific combinations of unusual physiological states. Although cultural and personal beliefs may lead to elaboration, interpretation of these states remains within the sensory modalities of the initiating physiological states. Specifically, we have presented evidence that the

hypnagogic and hypnopompic hallucinations (HHEs) associated with cultural myths, such as "old hag" assaults, are strongly constrained by the REM physiology of Sleep Paralysis (SP). Nonetheless, individuals differ in the extent to which they attend to and process these states. We here report the effect of fantasy proneness (FP)--the tendency to generate and enjoy hallucinoid imagery. FP was assessed in a sample of SP experiencers and non-experiencers.

Experiencers had significantly higher FP scores than non-experiencers, and high FP experiencers reported significantly more frequent and more intense HHEs. HHEs break down into three factors with a clear internal structure (Cheyne, Rueffer, & Newby-Clark, 1998). One factor, called Unusual Bodily Experiences, can be modeled as vestibular floating sensations leading to out-of-body-experiences which lead to sensations of bliss (Newby-Clark, Rueffer, & Cheyne, 1999). Structural equation modeling revealed that the association between FP and out-of-body experiences is completely mediated by floating hallucinations--suggesting that FP directly affects the tendency to experience vestibular stimulation as floating. FP is not sufficient, however, to have an out-of-body-experience, which requires the physiologically generated sensation of floating. Similar mediated effects were found for other groupings of HHEs.

## **8. What is Cognition Without Consciousness?**

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Descartes proposed two definitions of the soul, one "negative" and one "positive". In negative terms, the soul is immaterial. The positive counterpart of the definition is that the soul is a thinking substance. Descartes also proposed an epistemological constraint: that the soul is limited to that of which we have immediate knowledge and experience.

Helmholtz reformed the concept of mind by eliminating the epistemological criterion. In his view the mind is equivalent to thought regardless of whether we have access to the thoughts or not, making it possible for a process to be mental even if it is not conscious. Modern cognitive science has taken up this view, this time making the definition of cognition in terms of information processing. The core of the concept of "cognition" is, however, still Descartes' positive definition of the soul. The negative aspect is thrown out, along with the epistemological constraint.

A definition of cognition in terms of 'information processing' puts the delimitation of the mind at risk. Both the system that regulates the secretion of hormones and the perceptual systems will count as cognitive. One way to escape this is to assume that there is a difference, either in the processing or in the information itself in the two cases. But on what grounds can such a difference be established? Alternatively, we may try to update and refine Descartes' epistemological constraint, but is this possible without excluding unconscious cognitive processing, e.g. of the kind postulated by Helmholtz?

## **9. Hypnosis Can Evoke an Altered State of Consciousness.**

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The idea that hypnotic induction can lead to an altered state of consciousness (ASC) is highly controversial in hypnosis research. According to the "state"- theory, hypnosis evokes with high hypnotizable subjects essentially an ASC with its own characteristic neuropsychological and neurophysiological correlates. According to the rival "non-state" theory, all the psychological, physiological and behavioral changes associated with hypnosis can be explained without assuming any ASC. Recent attempts to resolve the controversy include the use of new brain sensing and imaging techniques that are expected to reveal the characteristic neurophysiological correlates of hypnosis. Although there is some evidence of such changes, the controversy has not been solved. The non-state theorists still refuse to admit that the reported neurophysiological changes should be interpreted as signs of an ASC.

In the present paper, this controversy between the "state" and "nonstate" theories of hypnosis is analysed from a theoretical and empirical viewpoint. First, we will argue that the disagreement largely concerns the definitions and criteria of the concept of "altered state of consciousness". If "ASC" is defined as a state in which subjective experience and objective behaviour are different from the normal waking state, then there is no doubt that hypnosis can be classified as an ASC, regardless of what brought these changes about or what the associated neurophysiological changes may be. Second, we will present our own recent findings on changes in event-related potentials during hypnotic hallucinations. These findings, along with other ones recently reported (e.g. Szechtman et al. 1998; Graffin et al. 1995; DePascalis 1994), show that hypnosis can evoke an ASC associated with specific neurophysiological changes.

## **10. Hypermnesia in Unilateral Neglect**

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Patients with unilateral neglect may implicitly process neglected stimuli, but it is not known if this information can gain 'explicit' access to consciousness. We tested this possibility by studying 14 right brain damaged patients with neglect with two explicit tests of memory of neglected stimuli (pictures belonging to 15 different categories): a recall test and a recognition test. The results of the recall test left only tenuous suspicion of memory for neglected information. By contrast, the retrieval of the same information was much larger in the recognition test. Our results demonstrate that formerly denied contralesional information may later be fully retrieved and given 'explicit' access to a conscious level of representation in the setting of a recognition task. This finding seems to suggest that consciousness of stimulus information at the time at which the external stimulus is still present is not a necessary

condition for acquisition and recovery of that information on explicit perceptual tests.

## **11. Memory for Information Perceived Without Awareness.**

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We report a laboratory method for demonstrating reliable, long-lasting effects of information perceived without awareness. In our experiments, we used briefly presented visual displays consisting of both a target word and a cross. Awareness of the target words was varied by requiring participants to focus their attention on either the target words or the crosses. Perception of the words was assessed by presenting the three-letter stem (e.g., pho\_) of each target word (e.g., phone) and instructing participants to complete the stem with any word other than words that had been presented in the visual displays. With this task, success in following the instructions is assumed to indicate that a word was perceived with awareness, whereas a failure to follow the instructions is assumed to indicate that a word was perceived without awareness. The results indicated that (1) focused attention to the words led to perception with awareness, (2) focused attention to the crosses led to words being perceived without awareness, and (3) the impact of words perceived without awareness lasted for at least 20 to 25 minutes. These findings show that it is possible to use laboratory methods to demonstrate reliable, long-lasting effects of information perceived without awareness. In addition, the approach can be extended to evaluate the impact of information perceived without awareness over periods of time lasting hours, days, and even weeks.

## **12. New Analysis on Dissociative Phenomena: A calling for a theoretical segregation between control processes and consciousness.**

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The analysis of dissociative amnesia (one of the core dissociative symptoms) reveals three main features which challenge current models of memory and consciousness. These are psychogenic primary origin, reversibility, and adaptive function. In relation to its psychogenic origin, dissociative amnesia challenges the neuropsychological models of human memory based exclusively on organic damage. In this respect, it is necessary to develop a broader approach to memory impairments in which both organic and psychogenic sources of perturbances could be accounted for. More specifically, its intrinsical reversible character suggests that dissociative amnesia is not a result of some kind of storage or consolidation deficit, but just a retrieval failure, being dissociatively forgotten memories adequately encoded and stored at an episodic level.

Additionally, the fact that dissociative amnesia seems to subserve an adaptive function (as a dissociative mechanism is properly achieved beyond conscious control) raises a new challenge to the supposedly close relationship between control processes and consciousness, suggesting a split up between them. From here, the following considerations will be stressed:

1. In addition to anatomical disconnections proposed as possible explanation for organic amnesia, some kind of functional inhibitory- disconnective mechanisms has to be postulated in order to account for dissociative amnesia.
2. Dissociative phenomena can be conceived as concerning 'how- functions' responsible for the availability of mental representations, instead of concerning the more classically described 'what functions' responsible for the content of subjective experience.
3. Finally, in contrast to traditional unitary conceptions about control processes and consciousness, dissociative phenomenology is in accordance with recent views stating both the disunity of consciousness and the segregation between monitoring and consciousness processes.

### **13. Source memory: What is the role of the frontal cortex?**

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It has been suggested that patients with lesions to the frontal lobes have difficulties retrieving source memory. We hypothesized that these deficits are secondary to an impairment in the use of strategic encoding/retrieval processes, often demanded in such tasks.

Subjects had unilateral excisions of frontal cortex or temporal lobe, or were matched normal controls. In one condition, a series of word lists that were each highly associated to "critical" non-presented words were shown to the subject. A subsequent recognition test examined the likelihood that these distracters, which are "automatically" retrieved through association, are mistaken for the target words (Roediger and McDermott, 1995). In our second condition, a series of word lists, each composed of members of different categories, were presented to subjects for study. The "critical" distracters for this condition were prototypical members of the categories studied. Endorsement of the critical word in the recognition test would occur if strategic processes had been used to identify the words as members of categories.

We predicted that temporal lobe subjects, who have general memory deficits, would have increased rates of false alarms in both the automatic and strategic retrieval tasks compared to frontal cortex patients and normal controls. Frontal cortex patients were predicted to produce fewer false alarms compared to the other two groups on the category lists, based on their inability to spontaneously use strategic processes.

Preliminary results show that the temporal lobe patients make more false alarms than both normal controls and frontal lobe subjects on both conditions.

### **14. Executive Control of Consciousness by the Frontal Lobe.**

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Developing the Frontal Lobe sections of my 1997 article on a Brain Model of Mental Imaging Abilities and of a long chapter I have in press on Consciousness, Motivation, and Emotion: Biopsychological Reflections in a book in the Advances in Consciousness Research series, I will begin with a survey of the areas of the frontal lobe: motor and pre-motor areas and the diverse prefrontal areas (superior midline & anterior-cingulate, orbital/ventral, and dorso-lateral pre-frontal) and their respective circuits with posterior and limbic lobes, basal ganglia, thalamus, and cerebellum.

Having read some 12,000 recent abstracts in brain imaging, human neuropsychology, and animal biopsychology, I will relate these frontal circuits to such issues as:

1) "spontaneous" vs "control" consciousness: the former arising from the temporal-lobe "ventral streams" which feed to the orbital/ventral pre-frontal areas; the latter stemming from the dorso-lateral pre-frontal's attempts to constrain the former in light of limbic input through the superior midline prefrontal/cingulate -- directly contesting Koch's (ASSC 1997 Conference) view that the frontal lobe is crucial for all consciousness.

2) the role of strong emotions in blocking "consciously controlled behavior" -- presenting PET scan evidence of the orbital/ventral and anterior cingulate ganging up together to prevent the dorso-lateral prefrontal -- premotor -- motor output system from moving "hysterically paralyzed" limbs.

3) "introspection" as a cognitive monitoring feed-forward system, likely utilizing superior-temporal-frontal circuits -- those most impaired in Schizophrenia. The left dorso-lateral prefrontal perhaps being essential for our ability to abstract ourselves from the spontaneous stream of consciousness in order to introspect.

4) the sociological sense of "self consciousness" -- the ability to see oneself and plan ones action in social context -- being closely linked with serotonin pathways to orbital/ventral prefrontal areas.

5) "consciously-chosen voluntary action" linked with dorso-lateral prefrontal -- threatened by orbital/ventral impulsivity and compulsivity. This relates to distinctions between 1. involuntary action; 2. voluntary action in response to external cue; 3a & 3b. voluntary action in response to internal cue -- w/o & w/ attention; and 4. attended voluntary action in response to internal cue w/ conscious comparison of possible outcomes. Orbito/ventral prefrontal seems to underly action in response to external, and dorso-lateral prefrontal in response to internal cues. Norepinephrine-fed right dorso-lateral seems important for vigilant focus of attention to allow conscious comparison, while dopamine-fed left dorso-lateral seems essential for

the conscious selection of behavior.

6) "Self as Body" and "Self as Agent": "Self as Body" is linked to the "body maps" of the dorsal parietal (area 7b), whose damage can lead to "somatic neglect" -- the loss of ownership of part of one's body. "Self as Agent" is linked to frontal areas such as the anterior cingulate, where damage can lead to the "alien hand" syndrome, in which one "owns" one's hand, but does not believe that one is the one moving it.

7) "Trait-Self-Consciousness" and "coherent self identity" involve a chain of retrospective retrievals from "episodic/autobiographical" memory, which seems linked to right hemisphere orbito/ventral and dorso-lateral areas.

The above assertions are part of a work in progress. What I finally present at the conference may differ in some details, but will be amply documented. I will attempt to relate philosophical treatments of such issues with such known or suspected frontal lobe circuits.

## **15. Delayed Self-Recognition and Episodic Memory in Preschoolers.**

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Adults recognize that the personal past, present, and future are connected. The development of young children's awareness of the connection between the past and present self was investigated in two studies. In the first experiment, older three-year-olds completed a delayed self-recognition task and an order memory task. In Experiment 2, three- and four-year-olds completed the delayed self-recognition and order memory tasks, plus a simple recall and a context memory task. We expected to find positive correlations among delayed self-recognition and episodic memory, indicating the development of a self extended into the past. Results offered support for these predictions such that scores on delayed self-recognition were positively correlated with scores on order memory in Experiment 1. In the second experiment, delayed self-recognition correlated with both order and context memory, with age and simple recall partialled out. We suggest that at around four years of age children can appreciate the connection between past and present personal experiences.

## **16. Recovery of fMRI Activation in Motion Area MT Following Storage of the Motion Aftereffect.**

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\* Presented by Jody C. Culham

We used storage of the motion aftereffect (MAE) to examine the relationship between conscious motion perception and activity in human visual motion area MT (V5). After adaptation to motion in one direction, observers report MAE in which a stationary test pattern appears to move in the opposite direction. The MAE is "stored" when a dark delay period precedes the test. That

is, following a storage period equal to the duration of the immediate MAE, the residual aftereffect lasts almost as long as the MAE without storage. Thus, storage provides a means to determine whether MT activity reported during the MAE (Tootell et al., 1995) is related only to the illusory percept of motion or whether it is also influenced by non-perceptual factors.

We used functional magnetic resonance imaging (fMRI) to compare the time course of MT activity during the MAE with and without a preceding storage period. fMRI data was collected using a 4T scanner for seven subjects during both the immediate MAE (adapt-test) and stored MAE (adapt-store-test). In each case, activity during the MAE sequence was compared to a control sequence in which the adaptation pattern oscillated and no subsequent MAE was perceived. During the storage interval, subjects remained in complete darkness with their eyes open. Like the perceptual effect, activity in MT dropped during the storage interval and then rebounded, reaching a level much higher than after the same delay without storage. Thus, MT activity appears to be highly correlated with the motion percept.

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## **17. Activation of High-Level Visual Areas during Recognition of Primed Stimuli.**

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Stimuli are easier to recognize when they have been primed (previously viewed). We conducted an experiment to investigate what areas of the brain are involved in producing this effect. To accomplish this, we had participants complete an object recognition task while we measured Blood Oxygen Level Dependent (BOLD) signal using functional MRI. To overcome the low temporal resolution of fMRI, stimuli were revealed to the participants gradually through a vertical grating. This increased the time that it took to recognize the stimuli and allowed us to record activation time courses. Primed objects produced less activation than non-primed objects in the occipitotemporal region, an area implicated in processing the perceptual properties of stimuli in order to determine identity. Primed objects also produced less activation in the intraparietal sulcus, an area implicated in the spatial reconstruction of degraded images. An analysis of the pre-recognition activation time course (i.e. before the participant was aware of the identity of the stimulus), showed that the signal from the occipitotemporal region increased at a faster rate for primed objects than for non-primed objects. Early visual areas showed little difference in activation between primed and non-primed stimuli. These results suggested that high-level areas in both the occipitotemporal and parietal cortex appeared to be involved in facilitating the recognition of primed stimuli.

## **18. Frontoparietal Circuits For Antisaccades and**

### **Antipointing: Auxillary Foci For Anti- as Compared to Promovement.**

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Functional magnetic resonance imaging was used to investigate the frontoparietal architectures for antisaccades and antipointing. An antimovement is an orienting movement in the opposite direction relative to the location of a visual stimulus and is thus relatively volitional as compared to promovement. Auxillary "anti-only" areas are likely to subserve a variety of higher order cognitive processes that include reflex inhibition, covert orienting of visuospatial attention, spatial working memory and coordinate transformation of the pro- to antitask sensory-to-movement vector. Subjects were imaged while performing five tasks: 1) active fixation 2) prosaccades 3) antisaccades 4) propointing 5) antipointing. When pointing, subjects maintained central gaze and pointed using the index finger and rotated about the wrist to equate the degrees of freedom for eye and hand movement. Talairach images were averaged across subjects and compared with fixation. Functional maps were then superimposed and active voxels colour-coded to indicate activity during a particular task or subset of tasks.

Several superior parietal and dorsomedial frontal foci were active during pointing but not saccades. This finding is consistent with monkey physiology, since the superior parietal lobule (SPL) projects to more dorsomedial frontal cortex whereas the inferior parietal lobule (IPL) projects to dorsolateral frontal and prefrontal areas. The IPL was active during both saccades and pointing. Frontoparietal areas selectively active or more active during anti- as compared to prosaccades include: 1) caudomedial posterior parietal cortex 2) midlateral IPL 3) the frontal eye fields, FEF 4) preFEF. There were less active voxels in the supplementary motor area (SMA) for anti- as compared to prosaccades. These have been suggested previously to underlie covert shifts in visuospatial attention, spatial working memory, movement inhibition and coordinate transformation.

In general, saccade foci were included within the pointing architecture. Areas selectively active and/or more active for anti- as compared to propointing *that were not more active for anti- as compared to prosaccades* include: 1) medial SPL 2) anteromedial SPL 3) anterolateral IPL 4) anterior cingulate 5) preSMA. The SMA complex was less active for antisaccades and more active for antipropointing and modulation of this region depended upon the intended action. There were less active anteromedial SPL and anterior premotor (mPM) voxels for antipointing. Antipointing-only areas were medial to shared antisaccade and antipointing foci. All areas more active during promovement were situated along the medial wall. In summary, auxillary cortical foci become active when one chooses to move away from a target instead of toward it.

### **19. Visual recognition of own face: PET activation**

#### **study.**

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Visual recognition of one's own face is essential form of self-recognition. We performed PET activation study to reveal cortical regions associated with recognition of own face. Subjects were measured regional cerebral blood flow during following three conditions; a control face recognition task (C), a passive own face recognition task (no explicit discrimination was required) (P) and an active own face recognition task (explicit discrimination was required). The present model was that representation of own face should be activated in both the P and A tasks to the same extent, and that attention to this representation and response selection should be revealed in the A task. The left fusiform gyrus and the right inferior parietal region were activated in the P and A tasks compared with the C task. Both are considered to be involved in the representation of own face. The right parietal activation have never been reported in previous face recognition studies, and this activation may be associated with the representation of own face as the part of own body. The prefrontal cortices, the right anterior cingulate, and the right pre-SMA were activated in the A task compared with the C and P tasks, indicating that these regions are involved in nonspecific attention and response selection. The left anterior insula was also activated in this comparison. Converging evidences suggest the possible involvement of the anterior insula in the representation of self, or "self-awareness".

### **20. A Multimodal Network for Involuntary Attention, Revealed by fMRI.**

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Our awareness of a given feature of the sensory world depends on whether or not it is the focus of attention. Attention is involuntarily drawn to stimuli which undergo some abrupt transition in state or quality. We have used event-related functional MRI to identify brain regions responsive to transitions in visual, auditory, and tactile modalities. Functional images were acquired from 6 male and 6 female right-handed subjects on a 1.5T GE "echospeed" MR system using a one-shot spiral sequence: TE = 40 ms, TR = 2000 ms, 25 4mm-thick axial slices, 3.125 x 3.125 mm in-plane resolution, 2 sec/volume. Stimuli in each modality were applied continuously but alternated between two different states (visual: red or blue shapes; auditory: running water or croaking frogs; tactile: brushing or tapping of the right lower leg). A transition between states in one of the three modalities occurred every

14 sec, in a randomized sequence, with 15 transitions per modality. Event-related activations corresponding to transitions in visual, auditory, tactile or all modalities were found by correlation to the predicted hemodynamic response. Visual, auditory, and tactile association areas responded specifically to transitions in their respective modalities. Areas responding to transitions in all modalities comprised the thalamus, basal ganglia, insula, cingulate cortex, inferior and superior parietal lobules, and prefrontal cortex. These data provide evidence for a central network underlying the involuntary orienting of attention, operating across modalities. The identification of both unimodally- and multimodally-responsive areas supports recent models of higher-level sensory processing mechanisms.

## 21. Feature Based Structuring of Binocular Rivalry.

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Binocular rivalry, where inputs from the two eyes compete to emerge in the subject's conscious visual perception, is a good model for studying subjectivity in the context of visual awareness. We conducted psychophysical experiments in which the subject is asked to track moving circles presented in rivalry, among other conditions. This setup allowed us to study the spatio-temporal structure of binocular rivalry in the context of visuomotor coordination. Using the visibility of the circles as the indicator of dominance, we analyzed the spatio-temporal statistics of the dominance shift. At the same time, we used the background color as the indicator for the spatial distribution of the ocular dominance. We thus look at the correlation between the moving circles and the overall dominance pattern. We construct a numerical model which reproduces the observed spatio-temporal statistical properties. This approach allows us to study binocular rivalry from the point of view of feature-based construction of visual awareness. Namely, we view visual awareness not as a simple mapping from the retinotopic field but as a dynamically constructed structure based on the set of visual features represented in the cortex. Based on our finding, we propose a model of visual awareness which gives new insights into the neural mechanism underlying binocular rivalry.

## 22. Maximization of Information in Binocular Rivalry.

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We studied the dynamical construction of visual awareness where inputs from the two eyes do not necessarily fuse into a single image, including the binocular rivalry condition. We found that the spatio-temporal structure of what the

subject observes in visual awareness is strongly affected by the spatial pattern of correlation of features in the two rivaling inputs. Under certain conditions, we found that the spatial pattern of the occurrence of partially low-pass filtered image rivaling against the original image strongly affects the spatial distribution of the resulting ocular dominant areas in the visual field. One surprising finding is that ocular dominance can occur in a patchy fashion, even violating continuity and connectedness in the topological sense. Thus, the visual system seems to be able to "design" the ocular dominance pattern in the visual field in quite a flexible manner. Our analysis shows that the general criterion for the resulting ocular dominance pattern is to maximize the available information, in which the image giving the more information of the two rivaling images for a particular locus in the visual field is "chosen" to emerge in visual awareness. This maximization of information results in a stable and coherent visual image, as long as the two rivaling images are correlated. When the correlation of the two rivaling images is low, an unstable rivalry resumes. We put forward a general mathematical model which explains these properties of binocular rivalry.

## 23. Chalmer's Unconscious.

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According to Chalmers' (1996) "double aspect theory", information spaces and states are realised phenomenally wherever they are realised physically. Hence a thermostat has phenomenal consciousness although it will certainly "not be very interesting to be a thermostat". However, his position must, in some way, be reconciled with the fact that much of our ordinary processing of information seems to be unconscious and non-phenomenal.

Chalmers does not address the problem directly, but his comment that the subject who has experiences is the whole system and not a homunculus within the system is of course relevant here. Two strategies seem possible. One might argue that the different information processing systems of our brains have separate phenomenal lives of their own. To reason in this way would certainly be very speculative, and most probably not in line with Chalmers' system-holistic intentions. The other alternative is to develop his holistic thesis about consciousness. However, in any interpretation it runs into the very difficulty which Chalmers argues is a basic problem for reductionism, namely, where to draw the line between a conscious and a non-conscious system. For example: Does consciousness disappear in a brain-dead person, or does it transpose to be associated with what used to be unconscious processing? If the former is the case, then there are information processes which are not phenomenal, and if the latter is the case the regulating centers of the brain stem, mysteriously, must go from non-consciousness to consciousness when brain death occurs.

## 24. Psychophysical Isomorphism, Qualia and

### **Psychologism.**

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Two major physicalist strategies concerning the body-mind problems have crystallized during the last century. The by far most influential one grew out from logical behaviourism and includes most of the modern reductive materialism. The second strategy had its earliest adherents among the Gestalt psychologists, who named it "the hypothesis of psychophysical isomorphism".

The behaviourist-materialist who claims that the scientific third person perspective can give us a comprehensive account of mind has to face the problem of "phenomenological qualities", or "qualia". A common strategy is to try to show that these strange entities are totally incomprehensible, and to dismiss the qualia hypothesis as prescientific prejudice. But the most prescientific thing about the usual conception of "qualia" is that it represents a ridiculously poor description of how these entities, whatever they are, are structured in perception. Hence the modern notion of qualia is misleading as to what kind of relationship you can expect to find between physical stimuli, brain processes and the phenomenal world.

To find out more about these relations, the Gestalt psychologists refined and developed the hypothesis of psychophysical isomorphism. The structure of the experienced world became an important key to the understanding of the physical processes in the perceiving organism. This poster sketches the main features of the Gestalt approach and its roots in 19th century epistemology, with a second focus on the Gestalt psychologists' physicalist answer to Edmund Husserl's famous attack on "psychologism".

### **25. A Suggested Method for Scientifically Addressing the Hard Problem of Consciousness.**

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Traditionally, the puzzle of consciousness has been approached from two distinct perspectives. One generally explicates the notion of consciousness using functional terms including "coordinated attention systems", "central workspaces", or "executive control modules". The other view has it that there is a problem of consciousness essentially separate from the above, the "Hard Problem", as it is called by a number of philosophers. Consciousness of this sort seems to be scientifically intractable, because it is tied essentially to "subjective" experience, and therefore outside the domain of "objective" scientific inquiry. No mere functional (or, some add, even physical) description can account for the existence or character of this singular trait.

Knowledge of our own consciousness seems to be

knowledge of a unique sort, not requiring the same kinds of justification as ordinary forms of scientific knowledge, even to the extent that a clear definition of the term or description of the phenomenon may be unavailable. How, then, can science even begin to investigate the Hard Problem of consciousness? Is it even a genuine scientific problem, or merely the result of conceptual confusion?

Given the unusual epistemic status of beliefs about consciousness (in this sense), I suggest that a viable route for scientific investigation of the Hard Problem may be not an attempt to demonstrate consciousness directly, but instead an inquiry as to the causal origin of the special belief in it which is to be found in human cognizers. If the source of such belief were found to be consciousness itself, the task of scientific identification would have been completed. Or, alternatively, some other cause of the belief might be revealed which was more amenable to functional description. The intractable notion of consciousness could thus be replaced by one accessible to scientific investigation.

### **26. Computability, hard problem and self.**

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The widely disputed argument in the philosophy of mind holds that the mind body problem can be decomposed into two parts, 'an easy problem' being ultimately explicable in information processing terms and 'a hard problem' which does not allow for reductive explanation. The hard problem is often associated with some form of the apparent noncomputable aspects of human mind such as intentionality or so called qualia.

The noncomputable mind objection taken literally rests on the assumption of the Church Turing thesis equating all computations with Turing Machine computability. It is not at all clear if noncomputability is essential for understanding the mind. Even if the answer to this question is affirmative, we will argue in this paper that mind noncomputability objection should be considered in the light of alternative models of computation emerging in computer science. These models provide broader notions of computability than Turing Machine and seem to be able to support reductionist explanation of the mind.

Noncomputability objection in a wider sense is often associated with qualia. However, soundness of these arguments have been seriously questioned by some authors. Although we are quite sympathetic with these objections, nevertheless, we think that still there remain something intuitively appealing in the question whether it is possible to describe the subjective experience in reductionist terms. We will argue that any such serious explanation must address modelling of self, i.e. the first person perspective. This necessary requirement, together with arguments about alternative computational models, enforces a dynamic view of the mind which most likely cannot be captured by the classical computational perspective.

### **27. Mind and Self as External Relations.**

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This paper argues that the human mind can be understood as a complex system of relations between a person and external reality. Treating relations as inference tickets, and against Brentano, it is argued that there can exist relations between two things one of which does not exist since without such relations our conception of time would be impossible. If this is right then the main obstacle to the theory of mind as relation is removed. The paper then explores this possibility by showing that, in particular, knowledge, belief, perception, emotions, memory , imagination do reduce to precisely such external relations. Next the concept of 'relation stripping' is introduced along with a corresponding fallacy in which we fail to acknowledge that we have stripped off essential relations from the conception of an object. It is this fallacy which is then seen to generate an exaggerated notion of 'phenomenal consciousness'. The paper ends by offering a more modest conception of consciousness and the Self.

## 28. Consciousness and the Experimental Mind.

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<http://www.multimedia.calpoly.edu/libarts/tdalton/index.html>

I contend, in this theoretical paper, that the explanatory gap (and deterministic traps involved in reducing mind to brain structures and functions) involved in theorizing about phenomenal experience can be bridged by treating the brain and mind as if they were experimental attributes of human development. My argument is that the human consciousness emerged or developed through a gradual series of neurobehavioral transformations that increased our adeptness at responding to the uncertainties and contingencies of experience to better understand nature and our own capabilities. The metaphor of experimentalism may help resolve the problems of subjectivity and the existence of other minds involved in the ascription of consciousness by illuminating how the "doubleness" of the phenomenal experience (subjectivity of perception and ontological uncertainty) is progressively reconstituted (but not eliminated) through the continuous conversion of the natural resources of human perception and behavior (i.e., gravity, motion, energy, space and time) into intersubjectively applied tools and methods (i.e., language, techniques of observation, and measurement) of human inquiry. The function of self consciousness in development has to do with the ways that judgment is used to progressively transform the uncertainty associated with physical, mental and behavioral characteristics of individual phenomenal experiences into forms of shared experience. My hypothesis then, is that *a theory of mind is a natural outgrowth of the human need to communicate about first person states of mind by imputing those states to others and then using that feedback to affirm a coherent sense of self.*

I propose that consciousness is a product of the interaction of brain and body in response to uncertainty and the demand for action. Consciousness mediates the relationship between nature and experience by furnishing a form of potential energy that enables individuals to become aware of different conscious states, and to find common mediums for rendering these phenomenal experiences replaceable and transformable. Treating consciousness as a form of potential energy enables scientists to avoid the pitfalls of reducing consciousness to specific brain mechanisms or structures. Instead we are free to trace the different neurostructural, functional, and experiential forms or configurations that mind and consciousness have assumed throughout evolution and during human development. I will explain why consciousness fruitfully can be considered a form of energy, the empirical consequences of doing so, and implications for a theory of mind.

Regardless of what metaphors we choose to characterize consciousness, they must be capable of explaining the relationship between global and local aspects of brain functions. They must also reconcile mechanistic and developmental conceptions of neurobehavioral processes. In addition, our theories of consciousness should furnish an understanding of how the mind evolved and the circumstances which brought about a preference for an experientially based scientific comprehension of nature and human behavior

I will furnish evidence from recent neurobiological research, paleoanthropology, and the studies of the history of scientific experimentation to support my theory that mind involves the intertwining of natural and experiential processes which make possible both shared consciousness and self consciousness. I believe that testable hypotheses of the theory of mind and consciousness, as I have framed it, can be derived from four related lines of inquiry, which include: pinpointing possible metabolic and neurobehavioral mechanisms which affect the availability, distribution, and expenditure of conscious energy; identifying the phenotypic lineage of neurobiological structures and reflexes subserving thought and behavior; establishing possible sequences of neurobehavioral development when consciousness emerged in hominid ancestors; and examining transformative episodes in the history of modern science which led to a preference for experience and an experimental approach to inquiry.

## 29. The Self In Want of a Homunculus: A Cognitive Neuroscience Perspective.

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Although William James (1890) contended that "No psychology ... can question the existence of personal selves" (p. 221), an important contribution of cognitive neuroscience to the study of the self will be to provide biologically plausible, computational models of the self that do not require a homunculus or functional equivalent. In the first half I examine progress toward such a mechanistic account, reviewing evidence on embodiment, identity,

control, agency, subjective unity, and self-awareness. Current understanding leaves little room for a homunculus. But what are the implications for the self—a fundamental construct in clinical, social, developmental, and personality psychology? It is typically assumed that the self is meaningful, and more or less exists, but the issues are more often dodged than addressed. In the second half, I argue that the lack of a homunculus does not imply that notions of the self are vapid. Rather, the self is as explanatory and valid a construct as other entities (drawing in part on Putnam's 1973 argument against reductive understanding as being fully explanatory). I discuss several reasons why the self appears intangible, and conclude that the self can be usefully understood as a computational level description (Marr, 1982) of the human being.

### **30. I-Self Emergence from Activation of Self-information.**

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Previously developed cognitive theories involving the self are critically flawed by the homunculus problem and its infinite regress. Baddeley modeled a Central Executive that supervises, monitors, and organizes with no explanation of how it is accomplished (Baddeley 1986). This Central Executive is a homunculus and problematic. Executive Function theory (Lyon & Krasnegor 1996; Rabbitt 1997) discusses executive abilities without a common definition or any common processes. The diverse list of executive functions is unorganized, only loosely associated by a sense of administration, control, and frontal lobe involvement. Executive Function deals with the homunculus problem by ignoring the self, and as a result is unable to cohere executive functions under an executive self.

The homunculus problem was created by a recessive controller method of explanation. 'A' is controlled by 'B' which is controlled by 'Me'. This linear attribution is inappropriate to describe any cognitive module within the interconnected neurocognitive system. The self agent is properly viewed as an emergent component of the cognitive system, constructed by this system, and exercising special direction upon it. An emergent agent does not arouse the infinite regress problem.

The principle assertion of this paper is that the Jamesian I-self (James 1890) is constituted by specific activation of a variable region of self-information. The activated region of self-information determines the motivations, abilities, and general character of the current I-self. The nature of self-information and the operation of this I-self within the greater cognitive system and the environment is discussed.

Baddeley, A. D. 1986. *Working Memory*. Oxford: Clarendon Press.

James, W. 1890. *The Principles of Psychology*. New York: Holt.

Lyon, G. R. & N. A. Krasnegor. (Eds.) 1996. *Attention, Memory, and Executive Function*. Baltimore: Paul H. Brookes.

Rabbitt, P. (Ed.) 1997. *Methodology of Frontal and Executive Function*. East Sussex: Psychology Press.

### **31. Consciousness and Cognition as Compensatory Responses to the Media Effects of Technology and Culture.**

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This paper proposes a theory of cognition and consciousness as a necessary compensatory response to the alteration and enhancement of biological functions that human creations produce. Each invention, by extending biological functions outside the body, alters the user's functional relationship to the environment, and so serves as a medium (mediator) of interaction with general properties to which each user must adapt. This adaptation produces a systematic media-specific alteration or media bias of perceptions and actions, a neurophysiological process related to Calvin's hypothesized pre-frontal "plan-ahead" mechanism evolved for throwing and speech. The simultaneous interaction of media-biased and direct ecological perceptions and actions provides new information to generate concepts and metaphors about the environment. Reciprocally, the self-consciousness of modern humans is explored as an enhancement of evolved primate self-knowledge mechanisms, such as visual-kinaesthetic mapping, through extension of this function to mirrors, clothing and symbol systems. Different symbolic information technologies, using evidence from archaeology, clinical research and neural-imaging, are demonstrated to alter cortical hemispheric function, and appear to influence the brain's labelling of mental processes as part of 'self' or as reified mental objects 'out there', and so alter the development of intentionality and theory of mind. This theory proposes that modern human cognition, consciousness, and our creations are interdependent. Further research avenues, based on the interactions between mind and media effects of technology and culture, are discussed that complement current physiological, cognitive, and philosophical approaches to studying consciousness.

### **32. Agency judgement in an alien hand task.**

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One of the central questions about the problem of self-consciousness and other-consciousness is to understand the experience of ownership or agency.

One approach for understanding the underlying mechanisms is to study disturbances of self-consciousness in schizophrenic patients. Indeed, one class of symptoms displayed by these patients, the so-called positive symptoms, are suggestive of an alteration of the awareness of one's own action and of the recognition of actions

performed by others. One hypothesis postulates that self consciousness relies on a discrimination between central representations activated from within and those activated by external agents. A first experiment by Daprati et al (1998) has attempted to test conscious recognition of self-generated actions; a situation was created where movements of an uncertain origin were presented to the subjects. They were shown the image of an alien hand visually superimposed to (and indistinguishable from) their own hand. Movements performed by the alien hand could be either in concordance or in discordance with the subject's own movement. Thirty subjects and thirty schizophrenic patients (hallucinated, non-hallucinated and deluded patients) were tested. In the trials where the movement of the alien hand was concordant with the subject's own movement controls misjudged the alien hand in 30% of cases. The error rate reach 80% for deluded patients and 50% for non-hallucinated patients.

Schizophrenic patients thus tend to overattribute to themselves actions produced by others and in conditions where the cues for discriminating the origin of an action are degraded. In order to analyse more precisely the influence of the perceptive information on this agency judgement we realised another experiment where the parameters of the visual information were controlled using an electronic device. Subjects hold a joystick with their right hand. The movements of the joystick were fed into a virtual hand holding a joystick. The virtual image was projected on a mirror overlying the subject's hand. This device allowed modifying the apparent direction and/or velocity of the movement actually performed by the subject. A manual motor task and agency judgement about this task were performed by ten normal subjects. This experiment will be expanded to a group of schizophrenic patients.

Daprati E, Franck N, Georgieff N, Proust J, Pacherie E, Dalery J, Jeannerod M, (1997) : Looking for the agent: an investigation into consciousness of action and self-consciousness in schizophrenic patients. Cognition; 65 :71-86.